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Sustainability of Projects Focusing on Access to Water in Ethiopia

Udržitelnost projektů zaměřených na přístup k vodě v Etiopii

Master thesis

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Prohlášení

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V Praze, 30.7.2021 Bc. Veronika Foltýnová

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Abstract

This thesis aims to address factors affecting the sustainability of development projects focusing on water supply in Ethiopia. The thesis identifies main dimensions of sustainability and examines factors within them and their impact on long-term functionality of the studied interventions. The research focuses on the (un)sustainability of the selected water supply projects in Sidama and Alaba, Ethiopia. Ten water supply systems constructed under three projects supported from the Czech development cooperation were examined. Data were collected through semi-structured interviews and direct observations of analyzed water systems. The interviews were conducted with experts, representatives of the implementing organization, representatives of water institutions in Ethiopia (Woreda Water Offices and WASH Committees) and recipients of the interventions, i.e. users of the water supply systems. This was supplemented by the analysis of project documentation. Field research in Ethiopia was conducted in November 2020 and lasted four weeks. The results showed ongoing long-term functionality with only minor problems in the majority of studied systems. One system was nonfunctional at the time of visit and two systems were facing serious problems. The sustainability of studied systems was affected mainly by contextual factors and challenges in governance, decreasing the perceived reliability of the service by its users.

Key words: drinking water supply, sustainability, development intervention, Ethiopia

Abstrakt

Tato diplomová práce se zaměřuje na faktory ovlivňující udržitelnost rozvojových projektů zaměřených na zásobování pitnou vodou v Etiopii. Předkládaná práce identifikuje hlavní dimenze udržitelnosti, zkoumá faktory v nich obsažené a jejich dopad na dlouhodobou funkčnost studovaných intervencí. Empirická část zkoumá (ne)udržitelnost vybraných projektů zásobování vodou v Sidamě a Alabě v Etiopii. Výzkum hodnotí deset systémů zásobování vodou vybudovaných v rámci tří projektů podpořených z prostředků české rozvojové spolupráce. Data byla sbírána prostřednictvím polostrukturovaných rozhovorů a přímých pozorování analyzovaných vodních systémů. Rozhovory byly vedeny s odborníky, zástupci implementující organizace, zástupci vodních institucí v Etiopii (Woreda Water Offices a WASH komise) a příjemci intervencí, tj. uživateli vybudovaných systémů. Výzkum je doplněn o analýzu projektové dokumentace. Terénní výzkum v Etiopii se uskutečnil v listopadu 2020 a trval čtyři týdny. Výsledky výzkumu prokázaly dlouhodobou funkčnost většiny studovaných systémů pouze s drobnými omezeními. Jeden systém byl v době návštěvy nefunkční a dva systémy čelily vážným problémům. Udržitelnost studovaných systémů byla ovlivněna především kontextuálními faktory a problematickou správou, čímž byla služba vnímána jejími uživateli jako nespolehlivá.

Klíčová slova: zdroje pitné vody, udržitelnost, rozvojová intervence, Etiopie

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List of Acronyms

CMP	Community Managed Project
EPRDF	Ethiopian Peoples Revolutionary Democratic Front
EU	European Union
IMF	International Monetary Fund
MDG	Millennium Development Goal
ODA	Official Development Assistance
OECD	Organization foe Economic Cooperation and Development
OWNP	One WASH National Plan
PIN	People in Need
SDG	Sustainable Development Goal
SNNPR	Southern Nations, Nationalities and People's Region
UNDP	United Nations Development Program
UNESCO	Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Emergency Fund
WASH	Water, Sanitation and Hygiene
WASHCO	Water, Sanitation and Hygiene Committee
WHO	World Health Organization
WWO	Woreda Water Office

Content

1. Introduction

It is estimated that 2 billion people live today in permanent water stress, i.e. a situation when demand for water exceeds its physical availability (UNESCO 2021). In addition to that, over four billion people experience severe water scarcity at least one month per year (Mekonnen, Hoekstra 2016). The problem is not only water availability, but also its quality. In 2017, in Sub-Saharan Africa, about 73 % of the population didn't have access to safely managed drinking water services (WHO/UNICEF 2019).

Consequences of unavailable safe drinking water, interwoven with issues around hygiene and sanitation, are severe and by many argued to be among the main drivers of persisting levels of poverty in many countries. Over 800 000 people die each year from diarrhoea, an illness which is preventable and possible to be cured effectively (UNESCO 2021). Health risks connected to polluted water have a great impact on livelihoods of especially rural communities. Repetitive sickness is a great constraint to important socio-economic activities, such as school or work, and connected medical expenses can place a compelling burden on the household budget (UNESCO 2021). In water-stressed areas with insufficient water availability, poor hygiene and inadequate sanitation are an usual result of prioritization of water use. Water is used for securing basic needs, as drinking and irrigation, and hygiene-related activities are often perceived as an unimportant practice. Research shows that when water is available within 30 minutes of walking, water use habits change significantly, as the amount of collected water increases (Brown et al. 2013, Nygren et al. 2016). For that, increasing access to *improved water sources*, i.e. protected sources which can deliver safe water (WHO/UNICEF 2019), is one of the long-term goals of the development agenda.

Despite many years of effort, access to safe water is still a challenge. Along with serious gaps in coverage (i.e. absence of infrastructure), major problems of water supply are low levels of functionality of the already existing infrastructure (Starkl et al. 2013; Pichon 2019; Schouten, Moriarty 2003). Similar as throughout the development sector, outcomes of water

supply interventions also face the challenge of sustainability. Combined with population growth and growing water demand, poor sustainability of the infrastructure is sabotaging efforts for improvement. Ethiopia is an exemplary case of the problem – in 2011, 27% of rural water systems in the country were nonfunctional (Haile 2019), and more than 30% of the rural population didn't have access to improved water sources (WHO/UNICEF 2021).

The objective of this thesis is to assess factors affecting sustainability of water supply systems financed from Czech development aid in rural and semi-urban areas in Ethiopia, and shed light on the roots of the problem. Through qualitative field research, interviews with stakeholders included in the management of drinking water supply systems in Ethiopia, relevant experts and representatives of the organization that implemented these systems and analysis of the project documentation, the thesis aims to assess the sustainability of these development interventions. The research analyses ten specific water supply systems in Ethiopia, which were implemented under three projects funded by a Czech development cooperation and completed from seven to three years before my survey. These projects comprised exclusively water systems based on the deep wells, i.e. boreholes. This technology is known to have potential in meeting water demand in a given environmental context but also, according to experts, reveals high rates of non-functionality.

Accordingly, this thesis examines the following two research questions:

What kind of factors do influence the long-term sustainability of development interventions on water supply?

What is the level of sustainability of the selected water supply projects?

By answering the first question, the thesis will outline multiple dimensions of water supply management and identify factors which affect

(un)sustainability of the studied systems. Identification of these dimensions is important for answering the second research question which examines whether the studied water systems are functional and how, and also whether and how they are used by local people.

In order to capture the complexity of the problem, a combination of conceptual frameworks and perspectives on the sustainability of development interventions was used. First and foremost, the thesis builds on the conceptual model suggested by Alexander et al. (2015). The model was designed for assessing key indicators of sustainability, i.e. very similar aim as of the presented thesis. Additionally, Alexander et al. (2015) build on research of rural water systems in Ethiopia, matching the area of interest with the presented thesis. The model offers a combination of dimensions and elements of sustainability suggested by other researchers as well (Ludi et al. 2013; Carter 1999; Mosler 2012; Pichon 2019; Schouten, Moriarty 2003).

Second, the present thesis extends the components of sustainability offered by Alexander et al. (2015) by considering the implementing organization's practices as an additional factor that can apparently influence the sustainability of implemented interventions. The problem of double accountability (i.e. accountability towards donors & recipients) of development organizations is often questioned by scholars (see Unerman, O'Dwyer 2010) in connection with aid effectiveness, and its assessment complements the main conceptual framework with additional perspective.

The text below is organized as follows. In the next, second chapter, I provide a basic overview of the Ethiopian context. In addition to an outline of general characteristics, it includes a brief description of the water governance in Ethiopia along with the identification of important stakeholders and strategies. The third chapter discusses the definition and conceptualisations of sustainability of development interventions and examines how it is acknowledged in relevant international, Ethiopian and Czech strategic documents. Further, the sustainability of water supply interventions is briefly discussed. The fourth chapter, as the main part of the theoretical section of

the presented thesis, offers an overview of factors affecting the sustainability of water supply systems. The chapter explains the main conceptual framework and its components and discusses literature that is relevant for the conceptualisation of the proposed research. The fifth chapter describes methods used in the various stages of the conducted research and related issues around its design and organization. The sixth chapter outlines the findings of my research, and the seventh chapter provides a discussion of these findings.

2. Context of Ethiopia

2.1. Country overview

Ethiopia with its 112 million inhabitants is the second-most populous country in Africa and 12th in the World (World Bank 2019). It is considered as one of the fastest-growing economies of the continent, with GDP per capita rising from 124 USD in 2000 to 855 USD in 2019 (World Bank 2019b). However, Ethiopia remains one of the poorest countries in Sub-Saharan Africa and the World, with a share of 23,5% population living below the extreme poverty line (World Bank 2019). As in other Sub-Saharan countries, recent economic growth and structural changes coincided with urbanization and internal migration. However, as for 2020, 78% of the population still remains rural (World bank 2020). Despite a continual decline in population growth, Ethiopia is one of the demographically fastest growing countries in the world, with an annual population growth of 2,6%, compared to 1,5% globally. It is estimated that in 2060, the Ethiopian population will reach 210 million (WPR 2021). The demographic development, particularly if accompanied by economic growth and increasing per capita consumption will certainly impose further pressures on the country's natural resources, including the water demand.

Two most populous ethnic groups are Oromo (35%) and Amhara (28%), followed by Tigray (7.3%), Sidama (4.1%), Wolaita (3%), Gurage (2.8%), Somali (2.7%), Hadiya (2.2%), Afar (0.6%) and other 12.6% (2016 est.) (CIA 2021). In total, 85 ethnic groups are recognized by the Government of Ethiopia, based on the National Population and Housing Census (NPHC 2007). After the collapse of the Dergue communist regime in 1991, the new ruling coalition, the Ethiopian Peoples Revolutionary Democratic Front (EPRDF) adopted the concept of ethnic federalism, to accommodate *"the complex ethno-linguistic diversity of the country and thereby reduce conflicts"* (Abrha 2019, p. 21). Such a system aims to reduce ethnic inequalities and manage societal tensions in the country while maintaining national unity and recognition of diverse groups. Moreover, ethnic federalism

can provide nations with a tool to decide and manage their affairs without the involvement of the central government (Abrha 2019). On the contrary, some authors (see Abrha 2019, p. 21) argue that ethnic federalism may fuel ethnic conflicts and violence, as it encourages and promotes ethnic differences and reinforces former tribal identities.

Additionally, as Pichon (2019, p. 13) points out, local governments in Ethiopia are accountable to higher state offices and often compelled to follow national targets and strategies, which are formulated by the ruling party. Regional autonomy, enabled by the decentralized ethnic federation system, is therefore interfered with the trickling priorities of the central government. A similar problem is described by Pichon in terms of budget allocation, as *"subnational governing bodies may lack the discretion to respond to local needs if they are at odds with the dominant political agenda"* (p. 14). As he further argues, the prioritization of new water infrastructure over maintenance of the existing could be an outcome of federal desire to fill the statistics on water coverage, while a true improvement on the ground calls for sustainable services (Pichon 2019, p. 21). Lenhardt et al. (2015, p. 6) also point out the insufficient autonomy of fiscal policies, resulting in the high dependency of lower administrative units on the central authority.

As for today, the ruling party is the *Prosperity Party*, a successor of EPRDF, which has been dissolved not so long after the appointment of prime minister Abyi Ahmed in 2018. For now, the Prosperity Party will run for the first time in the 2021 general election, originally planned for summer 2020 and postponed due to the COVID-19 outbreak. As EPRDF, the Prosperity Party is a coalition of several parties representing the ethnic heterogeneity of the country. One of the main aspirations of the party is to begin the transition towards non-ethnicity-based federalism and support a unified national identity. Such a move is now watched globally with concerns, as many say that the roots of ethnic division in Ethiopia are way too deep to be pulled out. As discussed by Abebe, Ahadu (2020), the level of understanding and desired cooperation among Ethiopia's nations also remains a concern. However, recurring ethnic-based violence in Ethiopia signals that the current system is not a perfect solution either. The limited power of the central government to

manage the country's common interests and needs may undermine its overall ability of coordination. The regional autonomy reinforces the political, social and psychological separation of ethnic groups, and may encourage separatist tendencies, continual conflict or even disintegration, with the former Soviet Union or Yugoslavia serving as an example (Abrha 2019, p. 22).

Although it is beyond scope of this thesis to analyze the political situation and perspectives of ethnic federalism, it can't be excluded either. Some of its consequences, namely the level of decentralization, the political culture of clientelism and weak accountability on all institutional levels, have a severe impact on the water sector and constitute a significant obstacle to its sustainability. As mentioned by research (Pichon 2019; Harvey, Reed 2007), water supply is a public service, usually provided by the state. However, in Ethiopia, the responsibility of water management is in the hands of the constituents, according to the principles of decentralization and community management models (see section 2.3). Except for extensive and complex projects, e.g. drilling boreholes or hydrogeological mapping, a large part of the planning and maintenance is done by local communities on a voluntary basis (Pichon 2019), which has serious consequences on its operation.

Ethiopia is divided into ten regional states on an ethnic basis. In addition, there are two chartered cities – Addis Ababa and Dire Dawa. Regional states are further divided into *woredas,* i.e. local districts with jurisdiction over important sector departments such as health, education or water supply. The smallest administrative unit is *kebele*. It is overseen by *woreda* and its size can range from small villages up to 5 000 inhabitants. In some of the most populous states, *zones* were established between the regional and *woreda* levels. As for today (July 2021), there are 68 *zones* in Ethiopia (CIA 2021; Pichon 2019).

The main part of field research presented in this thesis was conducted in the state of Sidama, which became an autonomous state only a few months before the visit. In a referendum, citizens of the former Sidama Zone voted for secession from Southern Nations, Nationalities, and Peoples' Region and Sidama became a new regional state in June 2020. The transition imposed a

big bureaucratic and budgetary challenge on the new state of Sidama, including the water sector and its functionality.

Ethiopia has diverse topography, with a number of highlands and lowlands, and the Great Rift Valley in the middle. The elevation ranges from -125 m to over 4,600 m above sea level. Climate is also varied, with semi-arid areas of the lowlands and tropical and humid in the southwest (Berhanu et al. 2014). Mean annual rainfall is 834.40 mm between 1991 and 2020, with the spatial distribution of around 2,000 mm over the Southwestern highlands and less than 300 mm over the South-eastern and North-eastern lowlands (World Bank 2020).

With several large rivers, Ethiopia has rich groundwater resources. Given the varied topography, the distribution is again uneven. Four river basins contain 80–90% of Ethiopia's water resources, but only about one third of the population resides in surrounding areas (OpenWASH 2016, p. 21). Additionally, the high seasonal variability of rainfall further complicates water availability in most of the regions.

Ethiopia also has significant underground water resources, however, its geology and lacking infrastructure make drilling difficult and expensive. The high occurrence of minerals, typically arsenic and fluoride in some of the deep aquifers, further complicates the water use (Beshah et al., 2016).
In absolute numbers, Ethiopia’s water potential is not small. However, along with physical obstacles such as seasonal and spatial variability of water resources, the main challenge of water accessibility is lacking infrastructure and limited financial resources for its development.

2.2. The race towards development

Over the past two decades, Ethiopia experienced significant progress in key human development indicators. Child mortality has been cut in half, access to basic services has improved and life expectancy has increased by 15 years since 2000 (Nakamura et al. 2020). At the beginning of the Millenium, the country suffered from one of the highest poverty rates in the world, as 57.8% of its population was living below the international extreme poverty line of 1.90 USD a day. By 2015, extreme poverty declined to 30.8% (World Bank 2021b). Despite the rapid poverty reduction, income inequality remained one of the lowest across the low- and lower-middle-income countries, as Ethiopia has been ranked 12th out of 84 countries by World Bank Gini coefficient estimates (Lenhardt et al. 2015, p. 2). Great progress has been made in education, with a primary enrolment rate of 84.6% in 2015 (World Bank 2021c). Progress in secondary education has been made as well, with the expansion of technical-vocational education and training and higher education system. Before 1990, there were only two universities in the country. In 2017, 800,000 students were enrolled in 37 public universities and 124 private higher education institutions (Yallew 2020, p. 2). However, the number of institutions is no panacea, as the increasing number of universities and enrolled students is often criticized for decreasing the education quality (Lenhardt et al. 2015).

Stabilization of the political situation after 1991 has made these changes possible. Since then, the Government of Ethiopia introduced a number of policies towards economic development and growth, with an overarching goal to reduce poverty and increase the living standards in the country. The government undertook a multidimensional approach, prioritizing agricultural development, education, transport infrastructure and water supply. According to Lenhardt et al. (2015, p. 5), up to 70% of the public investment budget has been allocated to these sectors annually over the past two decades.

Since 2010, the development and growth policies are guided by the *Growth and Transformation Plan I, II*, which often go even beyond the targets set by MDGs and SDGs agenda (Pichon 2019). Although the targets set by

these programs are far-reaching and ambitious, Ethiopia has been often mentioned among countries with great progress towards them (Pichon 2019; Lenhardt et al. 2015; Ludi et al. 2013).

It is important to mention that one of the motivations of the Government of Ethiopia on development achievements is to reach the status of a middle-income country, which is expected to happen in 2025 (if the growth trajectory remains stable). Pichon (2019, p. 17) explains this desire of the Government of Ethiopia to achieve an internationally recognized "*development success story"* and *"symbolic victory"*.

By institutionalization of its development strategies in several documents (e.g. *Sustainable Development and Poverty Reduction Program 2002-2005, Plan for Accelerated and Sustained Development to End Poverty 2005-2010, Growth* and *Transformation Plan I, II 2010-2025*), the Government of Ethiopia created a viable environment for receiving great amounts of development assistance. In the past decades, Ethiopia has been one of the top receivers of ODA, with a continual rise in the inflow (Geda, Tafere 2011).

In addition, many bilateral and multilateral donors are present in the country. The Development Assistance Group was established in 2001 to coordinate activities of donors active in Ethiopia and foster the dialogue between them and the Government of Ethiopia. As for today, it consists of 30 bilateral and multilateral partners, including the World Bank, IMF or EU (UNDP 2021). The aid effectiveness has been also targeted by the EU Joint Strategy for Ethiopia, which defines and coordinates concrete development objectives and activities of partners present in Ethiopia, one of which is also the Czech Republic (EU 2013). According to the website of the Ministry of Foreign Affairs, the Czech Republic has provided continual development assistance to Ethiopia since 2001. From 2011 until the present, Ethiopia is one of the "priority countries" of the Czech Development Cooperation.

2.3. Water governance in Ethiopia

According to the most recent estimates, only 13.6% of the rural population in Ethiopia had access to an *improved* water sources (safely managed + limited + basic service) in 2000, and 24.6 % of the total population (rural + urban). Until 2020, the share increased to 70.2% of the rural and 76.3% of the total population (WHO/UNICEF 2021). Significant progress has been made in terms of structural adjustments, budget allocation and strategic coordination. In 1995, the Ministry of Water Resources (Ministry of Water, Irrigation and Energy today) was established and overtook the responsibility of water supply management. Its strategies on the water supply followed the overall principles of the young government and headed towards decentralization of the water supply provision and community management (Pichon 2019).

Today, the overall national water policies are articulated in two strategic documents – the *Universal Access Plan II* and the *One WASH National Programme*. These documents articulate national targets for water and sanitation, both for rural and urban areas. The overall strategy follows the principle of decentralized services, with key ministries only coordinating the service delivery, which is done mainly by lower administrative levels, i.e. *woredas*. The strategy builds on small-scale water supply systems, with the use of simple and lower-cost technologies, such as hand pumps and shallow wells. These systems can be planned, constructed, and maintained by the local communities (Pichon, 2019).

The goal has been set to provide 85% of the rural population with access to improved water sources within 1.5 km to 25 liters per capita per day, and 75% of the urban population with access within 250 m 40 liters per capita per day by 2020 (Pichon, 2019, p. 14). Although these ambitious targets haven't been met, the coverage in Ethiopia improved significantly. Unfortunately, given the country's population growth, the absolute number of people without access to improved water sources remains unchanged (World Bank 2017). In addition and despite the rapid increase in the quantity of new water schemes, poor sustainability of the existing supply systems is undermining the

progress. It is estimated that at any given time, 30 – 60% of improved water supply systems are non-functional (Alexander et al. 2015; Arsano et al. 2010).

As mentioned above, important trends in the government water strategy are decentralization and access expansion. Such an approach allows the Government of Ethiopia to increase coverage and pursue the targets set in its policy documents like the *Universal Access Plan or Growth and Transformation Plan* and also targets set by MDGs and SDGs. However, only limited attention is given to sustainability and long-term perspectives, as continual functionality is often neglected by official statistics, and therefore much less attractive than new infrastructure (Pichon 2019).

The water sector in Ethiopia was built on principles of *community management*. The provision of water supply was still considered as public service, for which governmental institutions were responsible. With community management models finding their way into the official strategical documents, the responsibility has in fact shifted on lower administrative units and in the end, on communities. At its current stage, the Government of Ethiopia included the Community Managed Project (CMP) approach into the *One WASH National Programme*. CMP approach offers a framework for self-supply, community managed and owned supply systems, operating without supervision of any overseeing institution. According to it, *"water resources development shall be underpinned by rural-centered, decentralized management, a participatory approach, and an integrated framework"* (OpenWASH 2016, p. 25).

There are several pros and cons affiliated with this approach. As often mentioned by relevant literature (Jimenéz et al. 2019; Moriarty et al. 2013; Harvey, Reed 2007), community ownership and participation can improve the sustainability of the system, as all the costs and benefits are equally shared by the community, without any external influence. Additionally, Pichon (2019, p. 15) points out the potential of access expansion, given the condition of a low-income country with limited resources and capacities.

However, the CMP approach has serious shortcomings, as it requires access to information and skills. Given the fact that the target groups are rural,

vulnerable communities, such an obstacle might be insurmountable for many of them. According to the CMP, communities should be responsible for all stages of a project proposal, from funds localization to construction. CMP is also designed only for shallow and hand-dug wells, as more complicated schemes as boreholes exceed the capacities of rural communities (Mekonta, Boelee 2013). Locations with complicated water source access (i.e. deep underground aquifers) are automatically excluded from this system. These are usually "caught up" by international organizations working in the country, or specific governmental development projects. These projects are as well handed over to the community after finalization, following the overall strategy of community ownership and decentralized management. The key actors and their roles in the system are established by the federal water strategy (The Ethiopian Water Resources Management Policy), are defined in the following subsection. The structure is suggested by Figure 1.

2.4.Key local actors

WOREDA WATER OFFICE

Woreda Water Office (WWO) is an important middle body between local communities and national governmental institutions. According to the official documents, WWO should provide overarching support to local water committees (explanation follows), collect and share data on water supply, communicate requests and issues from communities to higher administrative levels and in some cases administer funds and oversee drilling or other construction-related activities (Ludi et al. 2013).

WWO is the lowest administrative unit receiving the state budget from higher levels, typically Zonal Water Offices, which is usually its only source of income. The size of the budget is dependent on many factors. Officially, it is the population size, water availability or percentual coverage. However, factors like political or ethnic affiliation may matter, as well as performance in previous years (Pichon 2019, p. 26).

Budget is used for wages and all expenses related to the service delivery, and its size has therefore a direct effect on the WWO's performance.

WASH COMMITTEE (WASHCO)

In the center of Ethiopia's water strategy stands the WASH committee. Its responsibility is to manage the local water supply system, i.e. collect fees, fund & perform repairs, cover operation & maintenance costs, facilitate spare parts, communicate with the WWO, hold regular meetings with the community, collect data and administer finances. According to the CMP approach, WASHCO is also the organ responsible for securing the water needs of its community. That means that if possible, WASHCO is expected to design, deliver and maintain the water supply system, including funding allocation and system construction. In case of boreholes and more complicated schemes implemented by an external agency, the system is handed over to the *woreda* and WASHCO is responsible for its maintenance (Pichon 2019).

WASHCO typically represents citizens of one *kebele.* Its members can be selected by the community or appointed by village leaders or elders. The committee members work on a voluntary basis, as no wage is affiliated with the job. This practice is often discussed by researchers (Harvey, Reed 2007; Moriarty et al. 2013), questioning the member's motivation for good performance if the service is unpaid.

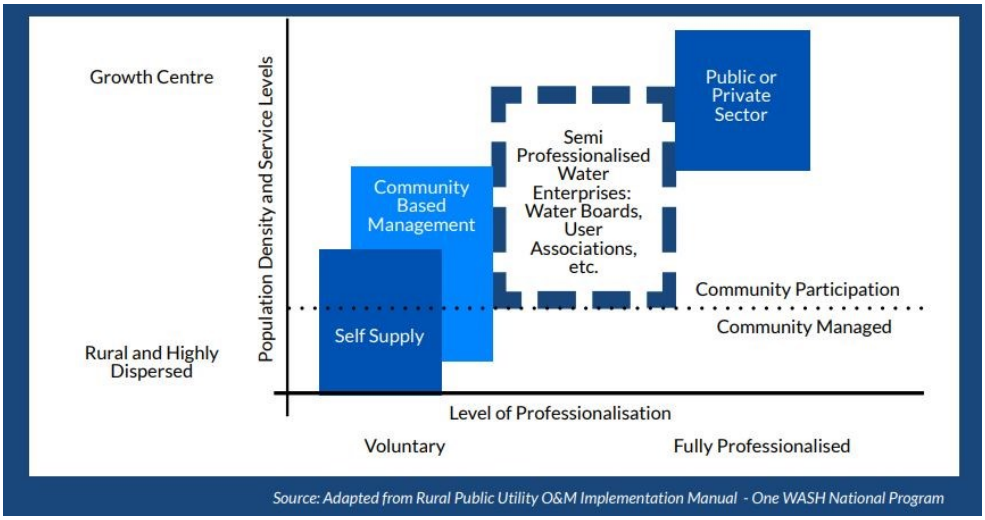
Operation & maintenance requires a range of skills that can't be expected in rural communities with limited access to education and information. As Pichon (2019, p. 25) points out, the committee is only as strong as its members. If no training and support are available, lack of budget, know-how and manpower can be fatal for the system functionality.

In 2012, the Regional Government of SNNPR modified its water policy by adopting Regulation No. 102/2012 (SNNPR 2012). The document aims to react to drawbacks of the federal policy, such as fragmentation of the system, weak monitoring, lack of administrative support or poor cost recovery. By the regulation, WASHCOs are renamed to the Water Users

Association and win legal status. Legal recognition extends their powers, such as accountability to a different office and the ability to open a bank account. The roles and responsibilities of the members remain the same (Haile 2019). As such is a national regulation and the term *WASHCO* is widely acknowledged by scholars and practitioners, it is also used by this thesis exclusively.

In semi-urban and urban areas, the responsibility is sheltered by Water Enterprises. Enterprise is a legally recognized unit with a clear structure and roles (McNicholl 2019). As water supply system management in urbanized areas requires larger operations and professional skills, Enterprise has greater legal power to enforce appropriate performance and services. Unlike WASHCO, Enterprise members have a wage.

Figure 1: Scheme of water institutions in Ethiopia



Source: McNicholl (2019)

COMMUNITY

As mentioned above, one of the central principles of Ethiopia's water strategy is community management and participation. The definition of a community, therefore, seems practical and useful. In the traditional sense, *community* implies a social body, a group of individuals with common interests or characteristics (Merriam-Webster 2021). In compliance with this widely acknowledged meaning, community-based water policies assume a naturally occurring ability of communication and cooperation inside the group. As Harvey and Reed (2007) discuss, the definition of a community in the rural water supply is not an easy task. A community can be a group of various people using a particular water supply system. Even if one system is designated for a particular *kebele,* it can realistically serve a much wider area, including people of different ethnicity, language, religion or tribe affiliation. In such a case, the water supply system is the only common interest of such a "community", in which communication or cooperation won't be, most likely, naturally occurring.

However, all members of this imagined community buy water and contribute to the budget, which wins them the right to be part of the group. It is beyond scope of this thesis to produce a new definition, humble discussion on the topic is presented instead. The term *community* is however used in this thesis

for the group of water system users, as it is an acknowledged and widely used label. Perhaps a more accurate “group of users” or “interest group”, would most likely lead only to misunderstandings and a new set of questions.

NON-GOVERNMENTAL ORGANIZATIONS

Non-governmental organizations (along with other international donors) play an important role in the Ethiopian water sector. They often complement the official system and structures, easing problems such as budgetary and material shortages, lack of capacity building programs or absent technical assistance. Especially in areas of low political or cultural importance, NGOs are filling the gap by targeting vulnerable and poor communities (Pichon 2019; Harvey, Reed 2007).

As most of the bilateral development partners of the Government of Ethiopia, NGOs are acknowledged by the *WASH Implementation Framework*, supporting policies and strategies outlined by the Government of Ethiopia (while delivering own projects as well) (Ludi et al. 2013). As Hopwood (2011) emphasizes, donor coordination is an important factor of aid effectiveness, as such could be threatened by the recipient’s ability to absorb the aid delivered.

However, the Ethiopian legislation is rather restrictive towards NGOs (and other foreign-based organizations). The government’s official rhetoric acknowledges the state as the only organ able to promote development and improve the lives of its citizens, while NGOs are often labeled as opportunistic actors promoting foreign interests. Under current law, the activities and areas of interest are restricted for international NGOs, as only local charities are allowed to work on human rights, democracy, national equality, nationalities, gender, religion, the rights of children and the disabled, conflict resolution and reconciliation, justice and law enforcement, elections, and democratization (Dupuy et al. 2015, p. 426). In practice, the agenda of foreign NGOs has to be strictly apolitical and along with official strategies.

3. Sustainability of development interventions

3.1. Defining the sustainability of development interventions

Understanding the term sustainability is diverse and often ambiguous, as it is widely used by politicians, researchers, practitioners, managers of private companies and the public, most often today connected to environmental or economic perspectives. Similarly, *sustainable development* is associated primarily with challenges of the *Anthropocene*. The sustainability of development interventions shares the central idea of continuity and responsibility of taken actions, however, its fundamental core lies in the desire to achieve sustainable progress in poverty alleviation (Kinsbergen et al. 2021). Taylor (2014, p. 1184) sarcastically mentions that environmental-based definitions of sustainability have been used in the humanitarian and development sector for many years as a „no harm" matter.

Probably the most widely used definition today, formulated by Brundtland (1987), describes sustainable development as *„development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". Perhaps a more universal definition offers Charles Kidd, stating that „*the wisdom of current policies and of proposed actions should be assessed in terms of their full long-range effects"* (Kidd, 1992; p. 3). The focus on continual benefits and value of development interventions over time is emphasized by definition used by the OECD, as: *"The continuation of benefits from a development intervention after major development assistance has been completed."* (OECD 2002).

As for today, the complexity of sustainability is often illustrated on a circle diagram of three central concepts of sustainability - social, environmental and economic. This simplified distinction can be applied to the development sector as well, implying the need for synergy of these three pillars. However, the problem is more complicated, as development interventions are usually goal-oriented, while sustainability as a general context aims for the long-term coexistence of complex systems. Additionally,

development interventions have to acknowledge specific contexts of target locations, making the one-size-fits-all approach unsuitable. Different studies point to the importance of other complements of sustainability in development interventions, as institutional, cultural or technical (see Purvis et al. 2019).

Sustainable development interventions aim for a long-term change towards set up goal(s). Based on the type and aim of the intervention, there are several ways to approach sustainability. The most desirable, as emphasized by Taylor (2014), is a *systemic change.* A change that creates (or changes existing) system(s), so it has the ability to provide the desired benefit itself. Externalities of such intervention can be very effective and have a long-term impact, however, its successful implementation is extremely problematic and challenging.

For that, most development interventions today have the nature of *one-time investment.* The initial input can be focused on an asset of any kind, from financial or material resources to capacity building. Once the initial donation has been made, there is no other input from the donor, however, the asset continues to deliver its intended benefits (Taylor 2014). Sustainability is achieved when a given asset continues to fulfill its purpose without the presence of the donor. Water supply interventions are mostly *one-time investments.* As assessed by this thesis, the obstacles imposed on its sustainability by limited project lifespan are significant, and for that water supply systems are just a perfect example of the need for systemic changes in development cooperation. Sadly, it is a long path to walk.

Another challenge in assessing the sustainability of development interventions is how they are measured and when. As sustainability is acknowledged as one of the central principles and desired achievements of development cooperation, ex-ante project assessment is widely practiced by donors and agencies. Focus is typically put on how the intervention meets the preconditions and principles of sustainability, evaluating the future performance and impact of it (Kinsbergen et al. 2021). As such is often

required by donors, it is natural that ex-ante evaluations are a part of almost every project proposal.

However, to analyze the true outcomes and impacts of an intervention, and particularly their sustainability, ex-post evaluation is very much needed. It is, unfortunately, not so common as ex-ante approaches. Post-implementation evaluation requires an intervention assessment after its finalization, which typically exceeds the project timeframe. It also requires additional financial resources and effort, which might not be present within the implementing agency (Kinsbergen et al. 2021, p. 5). The importance of ex-post evaluation is however enormous, because, unlike ex-ante evaluation, it can identify the real outcomes of the intervention and the chance that these impacts will be sustained in a longer-term perspective (Maier et al. 2016). Do the outcomes continue to exist after the donor withdrawal? Did the intervention deliver the benefit(s) intended? Is the benefit permanent? Did the intervention bring any unintended outcomes? These are only a few questions absolutely essential for assessing sustainability, and possible to be answered only by ex-post evaluation.

3.2. Sustainability of development interventions in strategic documents

Despite major achievements in eradicating poverty and improving livelihoods, development practice still faces many challenges – infectivity, unintended adverse consequences of interventions, mismanagement of funds, poor project planning and delivery or gaps in coordination, just to name a few. Significant critique also questions the sustainability of development interventions, targeting not only problems of long-term functionality but also on the (in)compatibility with local environments and societies (Purvis et al. 2019). The following section offers a brief overview of important strategic efforts to deal with the challenge.

The need for improving the impact of international development cooperation has been articulated by the *Paris Declaration on Aid Effectiveness* in 2005, a product of four *High-Level Forums on Aid Effectiveness* held between 2003 and 2011. The declaration formulated five strategic principles on how to improve the impact of aid on development: *Ownership, Alignment, Harmonisation, Managing for Results and Mutual Accountability.* It defines a set of measures and offers a monitoring system for progress assessment to ensure better coordination and quality of aid (Bissio 2013). The declaration addresses many issues and today it is considered as one of the most important guidelines for development cooperation. Unfortunately, the problem of sustainability of development interventions is not addressed as would be required, as only economic growth, institutions and recipient's policies are mentioned in connection to sustainability (OECD 2005). The declaration appeals to increase the amount of aid flows to achieve the Millennium Development Goals (MDGs) and offers incentives on better management and donor-recipient relationship (Bissio 2013), however, the sustainability problem was not targeted.

More attention to sustainability is given by the *Sustainable Development Goals* (SDGs), a successor to the MDG agenda of the United Nations. Unlike the MDGs, which simply defined the targets of international development cooperation, the SDG agenda reflects more on the interconnectedness of these targets and the need to link the social, environmental and economic effort. However, the overall focus is targeted more on environmental sustainability than on the sustainability of program and project outcomes delivered. The sixth goal dedicated to water and sanitation articulates the need to *"ensure availability and sustainable management of water (...)".* The subordinate targets *6.4* and *6.a* acknowledge the importance of water use efficiency, sustainable supply & management and capacity building support in developing countries. The target *6.b* addresses the aim to *"support and strengthen the participation of local communities in improving water and sanitation management"* (UN 2015, p. 18).

The articulation of MDSs and SDGs provided the international community with very much-needed guidelines for what needs to be achieved

and when aiming for harmonization and better cooperation on all levels. In terms of aid sustainability, there is still a lot to be done, as only broad recommendations exist today in the international community and the majority of donors are dealing with the problem on their own.

3.3. Sustainability in the development cooperation strategy of the Czech Republic

The Ministry of Foreign Affairs has the main responsibility for planning and realization of the Czech development cooperation. In 2008, the Czech Development Agency was established as an implementing and coordinating body of Czech development cooperation. Among other tasks, the main part of its agenda consists of topics identification in partner countries, announcement of tenders and calls for projects (Sládková 2011).

Currently, the *Development Cooperation Strategy of the Czech Republic 2018 - 2030* represents a main strategic document that articulates main principles and targets of the Czech development cooperation for the given period (MZV 2017a). The notion of sustainability is acknowledged in the document extensively, mainly in the context of economic growth and environmental impact. The sustainability of interventions is pursued through several recommendations, however, the document lacks a comprehensive framework or guideline. On intervention sustainability, the Strategy offers the following. First, *"innovative financial instruments (guarantees, venture capital, concessional loans and other soft instruments)"* (MZV 2017a, p. 20) as drivers and conditions of intervention sustainability. Second, ownership of the development programs by its recipients and a strong emphasis on reflection of recipient's needs. Third, use of local (material and human) resources. Fourth, capacity building and know-how exchange through experts and study opportunities (MZV 2017a). The document additionally stresses the need for better monitoring and evaluation of former interventions and better coordination and partnerships with recipient actors, other donors and international institutions and agencies (MZV 2017a).

Another practically important document is the *Methodology of the Czech Development Cooperation (Metodika zahraniční rozvojové spolupráce České Republiky*, author's translation) (MZV 2017b). The document is upgraded regularly with a new *Development Cooperation Strategy* coming into practice. For the projects studied by this research, a different document was valid for the given period, the *Methodology for the Project Cycle of Bilateral External Development Cooperation of the Czech Republic (Metodika projektového cyklu dvoustranných projektů zahraniční rozvojové spolupráce České Republiky,* author's translation) (MZV 2007), and it deserves to be mentioned as well.

The 2007 document stresses sustainability in all stages of the project planning, especially in its early phases. A clear emphasis on sustainability is articulated, as only "*projects which are of good quality, sustainable and owned by the beneficiary of the project"* will be supported (MZV 2007, p. 14). Every project proposal in the tender is designed to be evaluated and scored, with sustainability measures counting for 15 out of 100 points (p. 48). However, practical measures of sustainability are only briefly assessed as a final evaluation. The document states that the intervention outcomes will be monitored in two years following the project's finalization, in order to reflect on the outcome sustainability (p. 20). The need for post-implementation monitoring is widely recommended (see Crawford, Bryce 2003), however, in many cases, a two-year period is not sufficient to detect (un)sustainability of the desired outcome. Complex infrastructural interventions, such as water supply system construction, require more time to "settle down" and find its routine to reveal its sustainability over time.

If we compare the 2007 guidelines with the 2017 document, a positive evolution is obvious (MZV 2017b). Along with ex-ante sustainability, the most recent guidelines reflect the need for the post-implementation evaluation of project outcomes and offer specific structure and recommendations of such. Although the need for ex-post evaluation was also articulated by the 2007 document, it offered no concrete steps on the matter.

Another relevant document to consider is the *Bilateral program of development cooperation of the Czech Republic: Ethiopia 2018-2023* (*Program dvoustranné rozvojové spolupráce České Republiky: Etiopie,* author's translation) (MZV 2017c). It outlines specific targets and strategies of the Czech development cooperation with Ethiopia while acknowledging Ethiopia's strategic documents, namely the *Growth and Transformation plan I+II*. By defining specific areas of interest and (future) cooperation, the document contributes to better coordination and limits the risk of aid fragmentalization. In the case of water, the document specifies a concrete area of assistance allocation (SSNPR) and defines desired outcomes, i.e. expansion of water supply coverage, capacity building and promotion of hygiene and sanitation habits (MZV 2017c, p. 10).

Considering factors affecting sustainability (see Maier et al. 2016), the document fulfills several important tasks. First, it emphasizes coordination with relevant actors and stakeholders. Second, it stressed the need for ex-ante and ex-post evaluation, along with continual monitoring and reports. It specifically mentions the need for *„an assessment of the long-term impacts and benefits of development interventions in Ethiopia"* (MZV 2017c, p. 14). It also defines concrete recommendations and responsibilities for relevant actors included in the evaluation processes. Third, it articulates the need for a detailed baseline analysis of local context and power relations, in order to include local partners and facilitate the recipient's ownership of the intervention.

Unlike other Czech documents mentioned in this section, it also provides concrete indicators of sustainability (MZV 2017c, p.17). However, the focus is mainly put on "hard measures" such as "*number of people serviced by water distribution systems built"*, the matrix also assesses the importance of the recipient's performance. An indicator 3.6, *"yearly balanced or surplus budgets of water associations"* (MZV 2017c, p.17), acknowledges the importance of the project recipient's ability to make and manage financial plans. Financial management is indeed one of the top problems of sustainable management of water supply systems, as discussed in the following chapter.

3.4. Sustainability of water supply interventions

As the consensus stands today, securing ongoing service, i.e. sustainability of existing water supply systems is essential for fulfilling water-related development targets. As defined by Barnes et al. (2011, p. 169) sustainable water supply refers to *"the ability of services to continue to provide recipients with the intended human-health and lifestyle benefits without a significant adverse effect on other people, the environment, or other services, existing or potential"*. Carter (1999, p. 7) offers a simplified definition, such as *"sustainability is whether water continues to be abstracted at the same rate and quality as when the supply system was designed"*.

Until recently, water supply services in developing countries were managed and delivered by government institutions (Harvey, Reed 2007), following the principles of a top-down approach. Funding was often provided by international donors or agencies but delivered as budget support to the government. As in many other areas of development, such an approach for WASH services was later recognized as inadequate, as it ignores the specific context and needs of local communities, applying the "one size fits all" principle. The sustainability of such a service was undermined by insufficient governmental budgets, capacities, policies and commitment, and the absence of the *trickling-down effect*. Instead, the concept of *community management* was promoted from 1980' along with decentralization policies, with the aim to allow communities to participate in the decision-making process and provide them with a flexible and adjustable framework for water supply management (Starkl et al. 2013).

Community management of the water supply system is argued to be a composition of "soft" and "hard" factors, which affect its potential for continual and successful operation over time (Carter et al. 1999). However there are different perspectives on conceptualizing water supply delivery (see Barnes et al. 2011), consensus is present to the extent that sustainable management requires a suitable societal and institutional environment

("*software*") in addition to adequate technology solutions ("*hardware*") (Mosler 2012).

Technology choice and installation is a single-time event, but management (also referred to as operation & maintenance) requires ongoing effort. As mentioned above, in the past management was done by the implementing body, i.e. by governmental institutions or NGOs, and proved to be ineffective. Community management was hoped to improve sustainability, as beneficiaries (i.e. users, recipients) will have direct power over the system, along with strong motivation to secure its ongoing functionality. However, as many researchers conclude, it is no panacea (Harvey, Reed 2007; Arsano et al 2010; Jimenéz et al. 2019).

It is estimated that 30 - 60% of existing improved water systems are non-functional in any given time (Barnes et al. 2011, p. 169; Harvey, Reed 2007, p. 366), with errors occurring not long after its construction - the majority of failures are taking place between the first and the fifth year of the system operation (Banejee, Morella 2011). Shifting the responsibility for operation & maintenance from institutions towards communities indeed provided them with a voice, with a tool to decide how their needs should be met. It allowed individuals to participate in the process of project design and implementation and put the system governance in their hands. But it also placed a compelling burden on them, as management of water system schemes requires specific know-how, including technical, financial, managerial skills, along with basic hygiene and sanitation knowledge. Such skills cannot be expected to be present within rural communities, and have to be provided by the implementing institution or agency. The need for an external supporting institution(s) is still present, and for that community management itself can not guarantee the sustainability of water supply systems.

Harvey, Reed (2007, p. 367) further discusses the potential convenience of the community management approach for donors, in terms of the *project-based* activities practiced by many. When an implementing agency constructs several water supply systems under one project or intervention and hands over

the facility to the community to manage, the responsibility for its ongoing operation and sustainability is lifted from the implementing agency and put on the community. Similarly, Pichon (2019, p. 22-3) points out that governments are passing the responsibility of water services provision on communities, often without providing any tools to do so.

4. Conceptual frameworks

Development interventions of water supply are complex and require a comprehensive approach. Complex interventions can be defined as *interventions with multiple interacting intervention components and/or extensive and diverse interactions between intervention and context in which it is implemented* (see Thomas et al. 2021, p. 17.1.1). To understand complexity, a definition of (1) components affecting an intervention, (2) relations between those components and (3) interactions with pre-existing systems in which the intervention is implemented is required (Thomas et al. 2021). To understand and conceptualize the problem, it has to be explored as an independent unit, and simultaneously as an integral part of a wider context. The complexity of water interventions has important implications for the assessment of their sustainability.

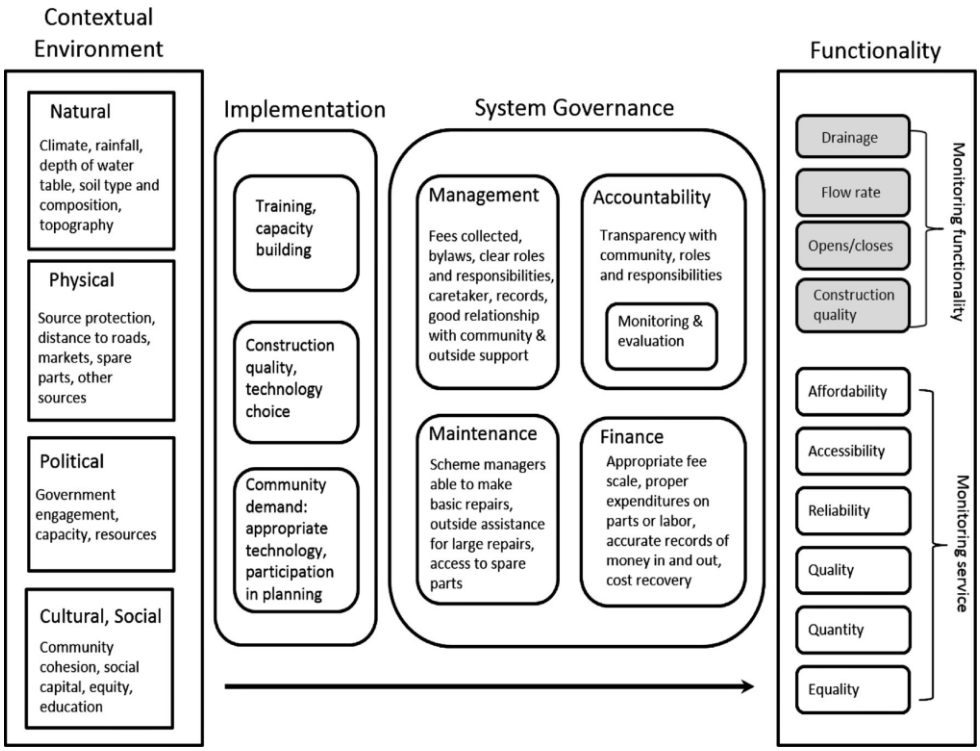
Determining factors (i.e. components) of water intervention sustainability exist and evolve in multiple dimensions, such as social, institutional, economic, environmental and technical dimensions which interact with each other (Ludi et al. 2013, p. 109). It can also be assessed by the nature of its components in terms of "hardware" and "software" segments of these interventions (Mosler 2012). It can be assessed as a chain of elements, implying the importance of time and continuity. Motivation, maintenance, cost recovery and continuing support are, according to Carter (1999), essential components of the sustainability chain (Carter 1999, p. 8). The variability of approaches illustrates the problem's complexity.

The diversity of factors affecting the success of water development interventions is widely considered as a major challenge of the water development sector, and also as one of the main reasons for the high level of water system failures. For purposes of the presented thesis, a conceptual model developed by Alexander et al. (2015) was found the most useful (Figure 1). The framework is thorough and covers all elements of sustainability mentioned by relevant research (Ludi et al. 2013; Carter 1999;

Mosler 2012; Pichon 2019; Schouten, Moriarty 2003). By outlining specific factors of contextual environment, implementation phase and system governance and linking them to water scheme functionality, the model provides a valuable heuristic tool. The model was used in the research design and for the interpretation of findings as well.

The model presented by Alexander et al. (2015) builds on previous research on rural water schemes sustainability, alongside tools and frameworks proposed by academics and experts from big international organizations, such as CARE organization or UN agencies. The model was applied for an analysis of the 89 rural water schemes in Southern Ethiopia, so its major advantage for this thesis is that it was designed and used for the same or very similar geographical context.

Figure 2: Main conceptual framework



Source: Alexander et al. (2015)

The main conceptual framework was further complemented by two approaches widely used for WASH interventions. First, The Integrated Behavioral Model for Water, Hygiene and Sanitation (Dreibelbis et al. 2013) was used to assess the nature of social and cultural characteristics and organization of behavioral determinants within the societies. Second, The Risks, Attitudes, Norms, Abilities and Self-regulation offered an effective tool for behavioral factor analysis. According to the model, the provision of technologies (hardware) has to be "*accompanied by programs that generate behavior change"* (Mosler 2012, p. 431). Water supply programs often neglect this *software* part, as physical water unavailability is perceived as the biggest problem, which can be solved by adequate technology, i.e. *hardware*.

4.1. Contextual environment

In consideration of water supply project implementation, aspects of local realities have to be accounted for. Local data gathering as an initial phase of any project proposal in order to learn the specific context is recommended by many authors (e.g. Barnes et al. 2011; Marks et al. 2018). The importance of contextual factors is recognized adequately by most international donor agencies, such as the World Bank or United Nation's agencies. Based on the proposed model, they can be divided into four subordinate groups.

4.1.1. Natural factors

Climatic, geomorphological and hydrological factors of the target location. In the Ethiopian context, most relevant factors relate to water availability, as such is also the prevailing cause of safe water deficiency in rural areas (UNESCO 2021). The availability of green and blue water changes over the year, depending on the climate and precipitation in the given area. In arid locations, the dry season creates a mismatch between freshwater availability and demand, increasing the level of water insecurity (Mekonnen, Hoekstra 2016). The options for water collection differ according to these factors, as in

arid areas deep underground aquifers can be the only safe water source. For such locations, a deep well (borehole) is the only solution, as shallow and hand-dug wells can not reach the aquifer level.

Freshwater availability remains an important factor also in locations where improved water source(s) have been developed. Near, naturally occurring water sources can undermine the community interest in the improved water scheme, where water has to be purchased for money (Marks et al. 2018, p. 14).

Water quality brings subsequent potential threats to the system's sustainability. Especially in the case of deep wells, additional water treatment might be needed for high levels of metals and minerals. In the Ethiopian context, chemical water treatments are often needed to decrease the level of fluoride, which is a naturally occurring mineral of mostly geological origin. Long-term exposure in drinking water can lead to severe health conditions, for example skeletal fluorosis disease (Mohammadi et al. 2017).

4.1.2. Physical factors

Physical factors refer to physical infrastructure availability in the target location. Insufficient level of supporting physical infrastructure is argued to be one of the key drivers of economic water scarcity, i.e. situation where water is physically available, but inaccessible due to lack of necessary infrastructure (IWMI, 2007). In the Ethiopian context, the common absence of electrical services is emphasized as one of the main infrastructural constraints, for which water systems are dependent on fuel-consuming generators (Schouten, Moriarty 2003). Road access and communication channels form another significant factor of sustainability. Difficult road access is one of the greatest obstacles for reaching local markets and therefore obtaining needed resources, such as spare parts, experts or attention of local authorities. However, as Alexander et al. (2015, p. 983) points out, insufficient road access can be partially compensated by responsible and

functional local government, which is able to foster access to markets and services.

4.1.3. Political factors

Both on the level of local governance (micro-level) and national strategies (macro-level), political factors and power relations affect sustainability greatly. The following section is focused on the importance of local governance, as national water policies are discussed in the chapter focusing on the Ethiopian context.

Appropriate engagement of local authorities in planning and decision-making can enhance project stability and support its sustainability. Local governments have a good overview of the local context, they have control over the implementation of water policies and they already have some kind of relationship with the benefiting community. Additionally, access to administration budget, experts, technology and know-how can be redirected towards the communities, increasing the ability of good operation and maintenance (Barnes et al. 2011, p. 184). On the contrary, mismanagement done by the local government, or absence of its support, can be a serious bottleneck to the project implementation and functionality. Corruption, nepotism and self-interests can be accounted for classical diseases of the political environment. Additionally, deficiency in institutional support can result in a disrupted accountability chain and potential system failure. Rural communities are usually unable to pay for major expenses, as their only income consists of fees collected from users. Major expenses usually need to be covered by a higher institution, e.g. local administration or implementing agency. Similarly, training and advanced monitoring require the assistance of the higher administrative unit than community leaders or local water committees (Pichon 2019, p. 23).

4.1.4. Social, cultural factors

The abilities of rural communities to manage their water systems evolve based on *social and cultural factors.* The socio-cultural background is a significant factor and its reflection in development intervention is needed, especially in cases that require community action and participation.

Alexander et al. (2015) use the terms *cultural, social* at the same level, however, its interchangeability is disputable. In this section, I approach the concepts separately.

Social characteristics are typically assessed on two levels (i.e. by scale). First, the individual (or household) level is assessed by scholars and practitioners to understand (also) the ability of single members of the society to create and maintain social networks or groups, to connect with other members, and in the context of development interventions – to facilitate change (Ling, Dale 2013). Education and income strengthen such an ability, as its presence at sufficient levels decreases the vulnerability and dependency of the group (Marks et al. 2014). For example, in case of need, wealthier communities are more likely to find alternative ways of funding, e.g. collect money or ask rich members of the community.

It is important to focus on community-level parameters as well, as society boundaries are often a determining factor for individual behavior (Marks et al. 2014) and participate in shaping the nature of structures within the society (and vice versa). The nature of social dynamics might even affect official institutions, as it influences the system and the ability of its representatives to introduce reforms and policies (Easterly et al. 2006).
Community characteristics are usually harder to measure for their multifaceted nature, and further research on their connection to development practices is needed. In WASH sectors where behavioral change is a necessary part of the intervention (sanitation and hygiene), assessment of psychosocial factors, i.e. norms, values and behaviors, is needed much more than in the case of water supply.

However, scholars suggest that community characteristics have a significant impact on the implementation and system governance of water supply systems, as its management is often done by communities. The level of expected cooperation and integrity in a community can be studied by identification of concrete psychosocial factors, such as *trust* among its members, *fractionalization* (i.e. ethnolinguistic, religious heterogeneity) of the society (Easterly et al. 2006) or *equity* among individuals and groups within the society (Schouten, Moriarty 2003; Platteau 2004), just to name a few.

Its importance is (among others) outlined by two comprehensive frameworks currently used for the design of behavioral interventions in WASH, *the Risks, Attitudes, Norms, Abilities, and Self-regulation model* (Mosler 2012) and *Integrated Behavioral Model for Water, Hygiene and Sanitation model* (Dreibelbis et al. 2013). However, these models do not pay any attention to the cultural aspects of the contextual environment, as they concentrate more on the psychological (or psychosocial) factors that are considered to be amenable through interventions.

Elements of *culture* such as ethnicity, language, cultural practices, religion or historical experience play also a vital role in the intervention process. Unfortunately, these factors are often neglected by the development strategies, and even by explanatory models offered by research. For example, religion is considered by the literature as an important factor of sustainability, as water has great importance in a number of rituals and religious practices. Additional value of water can therefore increase motivation and enhance responsible management of the water supply system (Behailu et al. 2016). As Johnston (2014, p. 224) points out, religion in general affects environmental sustainability, by shaping human attitudes towards nonhuman nature.

As Alexander et al. (2015, p. 978) outline, contextual factors are unchanging over a short period of time. Implicitly, they can be changed over longer periods, assuming that some of these changes might be very hard to anticipate, e.g. environmental changes or social dynamics in the community. As an existing consensus recommends building intervention designs on the

knowledge of the contextual environment, the need for program flexibility in case of unpredicted changes should always follow.
Additionally, the eligibility for a change differs among the dimensions of the contextual environment, making any generalization disputable. Some changes can be induced by adequate incentives in a relatively short time, while some are long-term outcomes or even externalities of surrounding processes.

4.2. Implementation

The project implementation phase should be responsive to local contextual factors (Alexander et al. 2015, p. 978), and represent the needs of the community. It has significant meaning for the future sustainability of the water system (Barnes et al. 2011, p. 169), as essential decisions are made in this phase. Successful implementation develops and strengthens the skills of the community to manage their water system in the future and provides them with all means to do so (Mathew 2005, p. 67).

Community demand, as an articulation of needs for specific services and resources offered by the intended intervention, is argued to be important (Mukherjee, van Wijk 2003). If there is no need for the project outputs in the community, very low interest in maintenance and functionality can be assumed.

Sense of ownership is considered an important outcome of the implementation phase and one of the key determinants of future sustainability and an essential prerequisite of responsible operation and maintenance (Schouten, Moriarty 2003; Barnes et al. 2011; Mathew 2005). In theory, community demand and participation in construction and decision-making help in building the sense of ownership, as the output is not simply given to the community by the donor or other institution (UNESCO 2021). However, like Harvey, Reed (2007) outline, there is no automatic relationship between ownership and responsible management of the scheme. For responsible and

sustainable management, the need for ongoing support towards the community is suggested to maintain the motivation and level of knowledge. For many agencies, participation in construction is an easy way of "sheltering" ownership. Unfortunately, digging a hole will not guarantee eternal ownership of the supply system.

Regular meetings with the community help to establish relationships and trust with the aid agency and clear out the future roles and responsibilities in management. The need for partnership usually exceeds the level of community - ongoing communication with all stakeholders, like other NGOs, local administration or private sector, should be present (Mukherjee, van Wijk 2003; Pichon, 2019).

A key element in planning community participation is training provided to the community. Management of water system schemes requires specific know-how, including technical, financial, managerial skills, along with basic hygiene and sanitation knowledge. For that, capacity building is an essential tool for enabling communities to manage all tasks connected to the operation and maintenance of the water supply systems. Training provided in the implementation phase has to be followed by additional support in the future. In order to maintain the level of knowledge and motivation, further institutional support (administration, NGO) to provide training is widely recommended by the literature (Barnes et al. 2011; Mukherjee, van Wijk 2003; Harvey, Reed 2007).

Along with the capacity building, the choice of suitable technology is done in the implementation phase. Community involvement in the decision-making process is supported by the literature (Jiménez et al., 2019; Bisung, Dickin, Dyer 2020), as unsuitable technology might result in instant failure of the system. However, the involvement of experts can not be neglected. The importance of community involvement in technology choice differs according to the type of water supply system. In the case of shallow wells and protected streams, the community is able to participate to a much greater extent than in the case of boreholes, where hydrogeological and technical expertise is necessary. Boreholes in general offer a lesser opportunity for

community involvement in technology choice or selection of locality, as such is given by the physical determinants of the location and decided by external experts.

4.3. System governance

Establishing proper governance of the water supply system is one of the key outcomes of the implementation phase. Governance, as other parts of the project design, has to be responsive to the contextual environment and respect the needs of the target community (Alexander et al. 2015, p. 978). In the Ethiopian context, governance of the rural supply systems lies predominantly in the hands of water committees (WASHCO). Its members usually work on a voluntary basis and receive support from higher administrative levels, typically the Woreda Water Office. Water committees are typically established by the implementing NGO or government office, and are responsible for *management (1)*, *maintenance(2)* and appropriate *financial services (3)* of the water system. Based on the level of success in three previously mentioned factors and WASHCO's relationship with the community, *accountability (4)* is built as an integral part of system governance (Alexander et al. 2015).

All four factors mentioned above require specific skills, which can be facilitated through training. In rural communities, where illiteracy can be still an issue, professional financial or managerial skills can not be expected. Therefore, the performance of the committee is highly dependent on training and capacity building provided by the implementing agency (or by other institutions). Moriarty et al. (2013) for example emphasize continual professionalization of water management bodies as a number one tool in targeting sustainable supply in rural areas. The committee composition is often not stable, as its members might not be elected again, leave the community or die. If training is not provided regularly, acquired skills can be also forgotten. Ongoing support in training provision is therefore crucial to train new members and maintain the level of knowledge and skills. The complexity of WASHCOs responsibilities presents a great challenge to the

system's sustainability, as it requires cooperation and relatively advanced knowledge in several areas. As Shouten, Moriarty (2003, p. 172) points out, only by strengthening skills, community institutions and management of water supply systems can be functional and sustainable.

4.3.1. Management

For the multifaceted structure of the schemes, its *management* requires clear roles and coordination among the committee members, discipline and a sense of responsibility towards the community. Role assignment is necessary for committee functionality, as different tasks require different skills. According to the Community Managed Project (CMP 2017, p. 42-43) approach manual, every committee should consist of a chairperson, secretary, accountant, cashier, auditor, storekeeper and one person potentially trained in operation and maintenance. Additional technical staff consists of a guard, generator operator, fee collector for each WP and a plumber. As CMP is an approach adopted by the federal water strategy, the official frame can differ according to the bylaws of regional states.

The know-how of committee members has been already emphasized as essential. Technical skills are especially important, as such expertise is an important landmark between self-sufficiency and dependence on an external body, e.g. WWO (Moriarty et al. 2013).

The composition of the committee members is also argued to be important, as members of marginalized or disadvantaged groups should have a say. As Harvey and Reed (2007) emphasize, in heterogeneous groups the level of trust and cooperation might be lower, and meeting the needs of all is more complicated. Additionally, Mukherjee and van Wijk (2003, p. 107) report that in a majority of observed locations, management of the water systems was elite-dominated. In such cases, real community participation is hard to achieve, as most of the planning and decision-making is happening “behind closed doors”.

Special emphasis is put on female participation. In Ethiopia, women are primarily responsible for fetching water, and also possess the greatest knowledge of water-related problems. Despite that, they are chronically under-represented in water system management (UN-Water 2006). The importance of women's participation is further discussed in section 4.5.

4.3.2. Finances and maintenance

The main responsibility of the WASHCO consists of *maintenance of the system*, i.e. monitoring and repair of all possible threats to the system functionality, and *financial management* (setting and collecting fees, record-keeping, finance management, cost recovery). The ability to collect the fees is essential, as such is often the only income to the budget on which all wages, repairs and fuel expenses are dependent. If finances are not managed properly, the chain is disrupted and all the following steps are endangered (Alexander et al. 2015). In theory (CMP 2017) water point fee collectors hand money to WASHCO's cashier, which will deposit them into a bank account. Then, if a repair or spare part is needed, the committee provides an adequate financial amount. In case of major repair, WASHCO is responsible for communicating the problem to the woreda water office to request financial and/or technical support. For that, a good relationship with the woreda office is widely recognized as an important prerequisite for sustainable management (Pichon 2019; Mathew 2005; Mukherjee, van Wijk 2003). Woreda office is the closest governmental body concerned about water treatment and supply for the administrative unit. The significance of governmental support has been discussed in section 4.3.1.

Another important factor of sustainability is argued to be record-keeping (Tucker et al. 2013; Alexander et al. 2015). Financial records are important for continuous monitoring and the ability to learn long-term trends, e.g. accessing the balance between income and expenses or profitability of the supply system. Technical reports are useful in a similar way, i.e. information about water flow, average water intake or history of repair (Pichon, 2019). Both financial and technical records also ensure continuity of

the governance system in case of personal changes in the committee. If such data are absent, the committee is not able to assess its economical situation, anticipate future development and adjust its actions according to the hard data (Barnes et al. 2011).

Monitoring and data collection should also be done by the WWO monthly. Such data are important for accessing coverage, functionality status and current problems of all supply systems in the woreda. These data are also further used in national statistics. Woreda offices have different systems of data collection, most of which are unfortunately dependent on human capacity and budget size. Pichon (2019, p. 17) defines "patchy monitoring" as one of the key bottlenecks to sustainability. Without accurate data, accessing problems with systems functionality is a time and energy-consuming process with insufficient results. Additionally, the lack of data on functionality has one important outcome - in official statistics, the coverage is defined by the number of existing water systems, not their functionality. This fact serves as a motivation to build new schemes instead of investing in their sustainable operation (Pichon 2019, p. 18-19).

As water committees should be representing the interests and needs of the community, a certain level of communication and understanding is needed. Regular meetings should be taking place, to provide space to raise and discuss water-related issues. Meetings with the community help to maintain a connection with the users, who can therefore participate and enhance their sense of ownership. In areas with insufficient water coverage, users are coming from distant places to fetch water, creating an "artificial" community with no other connection than a water collection place. Harvey, Reed (2007) emphasize the importance of communication especially in these cases, as in heterogeneous groups principles of community management are much harder to achieve and maintain. Holding regular meetings with the community, transparency and communication are argued to be essential in terms of gaining the trust of the community and enhancing levels of accountability (Barnes et al. 2011).

4.3.3. Accountability

A reliable chain of responsibility for different tasks of operation and maintenance of water supply systems is often emphasized as a key factor of sustainable management (Tucker et al. 2013; Schouten, Moriarty 2003). Accountability is argued to be important on several levels, but most importantly committee towards community and woreda office towards committees. Clear role assessment, responsiveness and most importantly willingness and effort of the personnel are the ultimate determining factors of cooperation and the level of services. As Signori and Bodino (2013, p. 117) point out, accountability is also an important tool of democratization and promotes sustainable economic and social principles and systems. Unfortunately, the performance of involved personnel is heavily affected by institutional and budgetary constraints, creating a vicious circle of poor performance and services. Despite the chain of accountability being set by laws and regulations, its real enforcement can be very far from the reality on paper (Jacimovic, Fonseca 2012).

The CMP manual (CMP, 2017, p. 43) specifically states that the management body, i.e. the committee, is non-paid. However additional technical staff (guard, generator operator, fee collector of WP, plumber) is eligible for a reward. The absence of wages given by the official manual brings up the question of motivation. As discussed earlier, the national water strategy of decentralization puts a number of responsibilities on communities, but fails in providing adequate means to carry them out. Management of the water system requires time, energy and effort from committee members, and should be fairly compensated. Membership in the water committee is often perceived as a service to the community, and therefore without an entitlement for a wage. The absence of financial reward has many implications, corruption and money misuse can be one of them. Poor performance of the water committee is often explained by the literature as one of the key reasons for unsustainable water systems (Tucker et al. 2013; Barnes et al. 2011), but often without mentioning the background of insufficient motivation. However, some authors do mention the connection – Alexander et al. (2015,

p. 981) associates financial compensation with higher functionality rates, Moriarty et al. (2013) questions the potential of (community management) approach based on informality and voluntarism (p. 329) and Harvey and Reed (2007) point out the different standards posed on water system management in high and low-income countries. Indeed, in more developed countries water management is done by professionals and rewarded by adequate wages. It can only be guessed what kind of service would be delivered if no wage would motivate western water professionals.

4.4. Functionality

Data on the functionality of water supply systems are an important tool for all stakeholders. On a local level, it allows the assessment of problems and challenges connected to the maintenance of the supply systems. On a regional level, local institutions gather information to assess economical and operational trends in water supply in the administrative unit. National governments design their policies according to data on coverage and access, and along with international agencies base planning and targeting strategies on such data (Garriga, Pérez-Foguet 2013, p. 1502). Appropriate datasets are therefore key information in strategic planning and problem assessment on all levels.

A major gap in monitoring is however defined by some authors (Alexander et al. 2015; Garriga, Pérez-Foguet 2013; Pichon 2019), as many studies and reports use binary measures in accessing functionality and sustainability of water supply systems. In a dual distinction between "functional" and "non-functional", many important indicators can be lost. Binary and simplified data might be useful, as they allow harmonized comparison over space and time, however, they fail to provide an accurate picture of the problem complexity (Garriga, Pérez-Foguet 2013, p. 1502).
First, binary metrics are unable to capture the fact that water schemes can be operating only partially, i.e. have slow water flow, broken faucets or contaminated water (Alexander et al. 2015, p. 978). Second, binary metrics

can’t access the underlying causes and contextual environment of different schemes. And third, binary metrics are based on a measure done at a single point in time, and therefore unable to offer information about a continual (non)functionality of a given scheme. As Alexander et al. (2015, p. 978) points out, such a “snapshot” can be useful for organizations to obtain data about the current functionality of their projects, but not for accessing the information on long-term sustainability. Interesting findings presented by Jiménez and Pérez-Foguet (2012, p. 509) on rural schemes in Tanzania show a 40% decrease in water service coverage when quality and year-round continuity were considered. Reasons for interruption of services can be various - physical water unavailability, i.e. dry season, insufficient precipitation, or infrastructural obstacles, such as power cuts or absence of fuel in case of motorized systems. For measuring functionality, the binary model is insufficient and a more integral assessment is needed. Continual operation of the scheme is only one component of functionality, which is further dependent on program outcomes discussed in the text below.

Components of functionality are derived from the level of governance practices. Adopted from the model offered by Alexander et al. (2015) and supported by relevant literature (Garriga, Pérez-Foguet 2013; Tadesse et al. 2013; Harvey, Reed 2007; Pichon 2019), four aspects of functionality are recognized in presented research - *affordability (1)*, *accessibility (2), water quality (3)* and *water quantity (4).* These four factors determine the reliability of the supply system, as such is believed to be the decisive factor of long-term sustainability.

Affordability (1) i.e. the ability of users to pay for water services determines the level of use, and therefore the amount collected on fees. The size of the fee, usually designed by the water committee, has to be affordable by all, i.e. even the poorest group of the community, but high enough to provide a sufficient budget for operation and maintenance (Ludi et al. 2013). If the price is too high and a considerable proportion of the target community can’t afford it, the functionality of the system is threatened by insufficient funding, as in the case the fee is too low to cover the costs of operation and

maintenance. It is important to note, that the price for water designed by the committee might not be the price paid by some of the users. Predominantly in areas where coverage doesn't meet the need of the growing population, insufficient *accessibility (2)* of improved water supply systems creates a space for a water-delivery market. Households out of walking range from the nearest water point can buy water from a "middlemen", who collects treated water and delivers it to remote locations. According to research presented by Banerjee and Morella (2011, p.164), the price can range from two to five times higher than the original fee paid by the contractor. Such services increase the level of financial insecurity of the most vulnerable communities, as only those without means of transport or free human power have to use the water delivery services for increased prices.

Water quality (3) and *quantity (4)* are determining factors of the community interest in water from the improved system and therefore affect the scheme's sustainability. The *quality of water (3)* deals not only with the chemical composition and/or possible health risks but also with perceived quality (smell, color, taste). Regular measure by sampling is recommended, however, such a practice requires equipment and skilled personnel, often unavailable in rural contexts. Additionally, even when a problem is revealed, the solution is often hard to achieve (Banerjee, Morella 2011). Typically, in the case of boreholes, increased levels of fluoride are a threat to the water quality and health of its users. In Ethiopia, simplified water treatment stations use chlorine to decrease the level of fluoride. Along with practical constraints of the cleaning process discussed in section 4.1.1 of this chapter, chlorine-treated water has a specific odor and taste, which is not health-threatening but might be perceived as such. As Figueroa and Kincaid (2010, p. 8) point out, in developed countries where chemical water purification is usual, consumers are used to the smell of chlorine. In developing areas, such a smell might be perceived as a threat and lead to malfunction of the whole water system. As the presence of fluoride in the water cannot be observed by taste or smell, untreated water might be perceived as safer than water treated by chlorine (Figueroa, Kincaid 2010).

In communities where an additional, untreated water source is present (i.e. ponds, untreated streams), chlorine smell can result in reduced willingness to pay for water from an improved system and increase the use of water from other sources.

Water quantity (4) is typically defined by flow rate (Alexander et al. 2015; Carter et al. 1999), i.e. the speed of water outflow at each water point. The time necessary for filling water containers (*jerrycan*) is particularly important in areas with low coverage, where existing schemes are being used by a high number of consumers. Slow flow rate and long waiting time increase the already existing burden placed on the users, as it is a time and energy-consuming process (Banerjee, Morella 2011). Additionally, Carter et al. (1999) connect insufficient water availability with *water-washed* diseases, as inadequate quantities of water restrain poor hygiene habits.
In the case of boreholes, based on the size of the aquifer and technology type, every scheme has a recommended daily yield. Following such recommendations is important for the sustainability of the aquifers (i.e. natural water recharge) and long-term functionality of the system, as over-pumping might result in clogged filters and premature deterioration of the borehole. Management of overcrowded schemes with high water demand might face the dilemma of over-pumping, and therefore satisfying more customers (and subsequently increasing income). However, such a practice may lead to irreversible damage to the system in the long-term perspective (ICRC 2010).

Water quantity is additionally affected by seasonality. Precipitation affects the levels of underground water or the presence of additional water sources such as ponds or creeks. However, even such environmental determinants are possible to be solved by proper management. The desired outcome should always be regular water availability, i.e. water should be present on agreed and expected times and levels. When achieved, the supply system is considered reliable by its consumers and used regularly.

Reliability of the supply system is a major determinant of sustainability and a major outcome of it. Concerning reliability, Carter et al. (1999) define the continuity of water supply as one of the main objectives of sustainability, as only continual and reliable water supply can be a sufficient driver of its regular usage by consumers. The continuity of the water supply is affected by a variety of factors, some of which are hard to control. However, by proper management, the vulnerability to outer threats (i.e. precipitation, drought) can be reduced and the reliability of the water system preserved.

4.5. Gender aspects

As women and girls are often responsible for water collection for the household, their participation in the water supply systems is considered essential. It has been shown by research (van Wijk-Sijbesma 1998; Schouten, Moriarty 2003; Ray 2007) that women's participation in all project stages improves sustainability and effectiveness of water supply systems. Especially in rural communities, traditional gender roles are weakening the women's ability to do so.

Although women are considered the most knowledgeable group about water supply, they are widely excluded from planning and management. Such a fact has an impact not only on the functionality of a given system but also further reinforces existing gender gaps. As managerial bodies are dominated by men, women are excluded from all associated benefits such as capacity building, income or professionalization (UN-Water 2006).
While being excluded from the decision-making process, the burden of fetching water is put mostly on women, with all its hidden costs. Time and energy spent on fetching water could be used for other activities with life-improving aspirations (e.g. education). Long travels, especially when done by women, are also often connected with an increased risk of sexual violence. Serious health risks are also imposed on women, given their specific needs of hygiene (Ray 2007).

4.6. Implementing organization

Conceptual frameworks and objectives presented in this chapter offered an overview of factors of sustainability in the water supply sector. Inspired by literature and studies concerned by the topic, it analyzed mostly circumstances "on the ground", connecting social, economic, institutional, technical and environmental dimensions of the recipient's context. However, there is one more important factor affecting the matter, and that is the characteristics of an organization implementing the intervention (Pichon 2019). Such a perspective might indeed be overlapping with factors presented on the preceding pages, as such is an explicit outcome of the intervention logic designed by the implementing organization. However, it can't be excluded if the matrix of sustainability factors shall be complete. The presence of relevant structures, policies, know-how and expertise on the side of the donor is its integral part (Conyers, Mellors 2005). The ability of the organization to foster sustainability of its intervention depends on many factors (see Easterly, Pfutze 2008), which can be simplified and summed up into three clusters: *expertise, cooperation and background.*

EXPERTISE

Development assistance, in general, is a wide and dynamic sector, with an unfortunate gap between research and practice. However, the gap is (hopefully) getting smaller with the increasing professionalization of the sector, interventions produced by "outsiders" has been common practice in the past (Conyers, Mellors 2005).

Insufficient organization's know-how and expertise of its staff can result in inappropriate intervention, which can do more harm than good. As studied by many, aid can have severe consequences on livelihoods, sparking conflict, undermining local institutions and policies or disbalancing the existing power relations (Easterly, Pfutze 2008; Koch, Schulpen 2017). An organization's know-how can be a serious bottleneck of intervention sustainability (Crawford, Bryce 2003), as poorly planned projects are more likely to fail.

Theoretical knowledge of development practices and recent trends should be also complemented by high-level expertise in the specific development sector, in our case the WASH. As suggested by this chapter, it consists of a number of "hardware" and "software" (Mosler 2012) factors, all of which require attention in order to achieve sustainability. It is less likely that an organization without sufficient knowledge, experience and capacity will be able to cover them sufficiently.

COOPERATION

Recipient ownership of the project outcome is today considered as a prerequisite of sustainability and ongoing functionality of development interventions. Participation of all relevant local stakeholders in all project stages is argued to increase the willingness and commitment of recipients to maintain the asset and invest resources even after the withdrawal of the implementing organization (Conyers, Mellors 2005). The ability of the organization to foster this connection is therefore essential.

The organization should be accountable not only to direct beneficiaries of the intervention, but also towards local institutions and officials, i.e. follow the principles of *downward accountability* (Unerman, O'Dwyer 2010). Securing local ownership is not the only beneficial outcome of cooperation, as improved trust towards the donor results in a better possibility of future intervention and cooperation. For that, the long-term presence of the donor and its knowledge of local realities is argued to be very helpful in terms of sustainability prospects. Knowledge of local context can also enhance the ability of organization representatives to cooperate not only with the formal sector, but also within the informal structures (Hopwood 2011, p. 111).

Additionally, intervention should be in line with governmental strategies and policies, and ideally done with direct consent and cooperation with its representatives (Conyers, Mellors 2005). First, it allows future scaling-up of the intervention. Second, it helps the reputation and image of the organization in a wider country context. Third, it increases institutional support and therefore has a positive effect on sustainability of the intervention.

BACKGROUND

Aiming for sustainable and effective aid, recent recommendations articulate the need for shift from project-based intervention towards programme-based. Such a practice is argued to bring better coordination among donors and better continuity of aid delivery (Figueroa, Kincaid 2010). In terms of sustainability, poor continuity is visible primarily in the obstacles imposed on long-term presence of the implementing organization, as such is often restricted by limited project duration.

In both bilateral and multilateral development cooperation, organizations are dependent on funding by superior donor agencies, and obliged to follow its requirements. In some cases, this practice is indeed

beneficial in terms of aid coordination. Superior donor agencies, e.g. on (inter)national level, have greater capacity to design and implement long-term strategies as they possess structural, financial and human resources to do so. However, at the end of the money disbursement chain, there are several drawbacks. First, the budget continuity above the project span is uncertain. The activity of implementing agency can be therefore terminated, if the funding organization decides to support other project proposals. Continuity of aid is therefore dependent on superior agency, which might not have as a good overview on the situation as the implementing one. Second, the implementing organization has to follow targets and requirements set up by the funding agency. Such practice can result in blind concentration on numbers and statistics, while ignoring less obvious but effective solutions. As the funding agency often lacks the experience and local context insight, it is also more likely to apply the "one size fits all" approach (Hopwood 2011; Conyers, Mellors 2005).

The performance of the implementing organization is therefore affected also by external factors of its institutional background, i.e. *upward accountability* (Unerman, O'Dwyer 2010).

5. Methodology

In the following section of my thesis, research methods are discussed. I begin by outlining the challenges of the preparation stage, as a crucial part for entering the field and securing informants and interviews. Then I discuss the field research, outlining the methodology of data collection and circumstances affecting this process. Followed by data analysis methodology, I conclude with a discussion of possible limitations of presented findings.

To assess the matrix of factors affecting sustainability of studied water supply systems, different types of data have been used. First, project documentation was examined to assess the background and design of studied projects. Second, data obtained by the interviews with four groups of water supply stakeholders were collected and analyzed. Third, policy and strategy documents of Czech and Ethiopian governments on development cooperation

were studied, as such constitute a frame within which all the actors operate. Addition to that, a mixture of documents and policy papers complement this research.

Three main parameters for project selection were firstly defined as follows. First, only projects funded by the Czech development cooperation were taken into account. This condition was set for better possibility to contact representatives of the implementing organizations and better access to project documentation. As a second criterion, I identified projects focusing on water supply completed not later than five years ago (i.e. not after 2015). As (un)sustainability is not observable immediately (Crawford, Bryce 2003), the five year limitation was designed to provide a sufficiently long period for problems to be revealed. As I found out later, one of the selected projects was delayed and completed only three years before this research. Third parameter was the geographical location of the project sites, to fit the limited capacity and financial resources of the research. All selected projects are presented in Appendix 1.

After analysis of documents on Czech development cooperation available from the website of the Ministry of Foreign Affairs and kindly provided by the Czech Development Agency, I identified several projects on water supply fitting the conditions stated above. All selected projects were implemented in the SNNPR Regional State, as it has a long history of cooperation with the Czech Republic in the field of water supply. Two projects were identified in the Sidama Zone (today Sidama Regional State) and one project in Alaba Special Woreda. As the number of projects is limited and there are not a lot of Czech organizations focusing on water supply development in Ethiopia, only projects implemented by the People in Need organization (PiN) met the criteria. In case of one of the selected projects in Sidama, it was implemented by a consortium „Sidama Water Supply " of Ircon s.r.o., Aquatest a.s. a GEOTest a.s companies, with PiN as a subcontractor for project activities on capacity building and training. In the two other projects, the logic was opposite – projects were implemented by PiN, with subcontractors on hydrogeological and technical activities.

After selection of the projects I approached the Czech office of PiN, with the hope to get access to project documentation of selected water schemes. I was able to meet with Jan Faltus, an expert on WASH interventions, who shared some of the project documentation with me, along with essential information about the projects, Ethiopia and water supply.
I was, at the time, very new to the whole topic. The possibility to consult my questions and queries with such an expert was extremely valuable, as it helped to understand the matrix of water supply intervention, which I knew only from the academic perspective. Establishing this connection was also essential for planning my field research. Mr. Faltus helped me to connect with the local PiN office in Awassa, which was later crucial for successful data collection.

Unfortunately, I wasn't able to obtain complete project documentation for all considered projects, probably due to their sensitivity. Mostly, I had annual and final reports from the projects, along with the tender proposals from the Czech Development Agency.

Based on the project documentation analysis, and available literature on sustainability of water supply schemes, I created a map of stakeholders. Although it is a method used mainly in management and business studies, it is also applicable in other disciplines, and helps to reveal the roles of different stakeholders, as well as a connection between them (Mitchell et al. 1997).
With a clear idea about all interest groups, four categories of prospective research participants were identified: (1) beneficiaries of the improved water source, (2) members of the local water committee, (3) administration offices on the woreda level, (4) experts on water supply and implementing NGO (PiN) representatives.

Qualitative research methods were applied, with the main data collected through semi-structured interviews. In order to obtain data on roles, relationships of all groups of stakeholders, and its effects on sustainability, a different set of topics (often complemented by open questions) was prepared for each group of informants. They can be found as an Appendix 2.

Among other advantages (see Longhurst 2003), open questions gives the informant a chance to raise own ideas and issues, which couldn't be raised by the researcher and might remain hidden (Valentine 2005).

The field research took place in November 2020. In four weeks, I visited ten villages in the Sidama region and Alaba Special Woreda, and conducted 34 interviews. To be able to learn the context, three categories of informants were interviewed in the field: 1) beneficiaries of the project, as a target group and final users of the scheme; 2) water committee members, as the lowest agency responsible for management of the water scheme; 3) woreda water office, as a higher administration body, connecting the local communities with state infrastructure and possible government budget. Some of the interviews were carried as focus groups. Even though it was not planned, it was simply impossible to avoid it in some cases. It concerns mostly the water committee members, which simply gathered after my arrival to the village and refusing them would be very rude.

In addition, I conducted interviews with water experts and PiN representatives. Those interviews were carried mostly at the beginning of the field research, shortly after my arrival to Addis Ababa. They gave me a good starting point and provided me with many valuable information, on which I built later in my research. My informants consisted of PiN staff, academics from Addis Ababa University and experts from Czech hydrogeological company operating in Ethiopia. More interviews with experts and PiN representatives were carried out after my return from the field research, in December 2020 and some more in July 2021.
Some of these interviews are not included in the research, as they were more of a discussion on the topic and didn't have any structure.

My trip was affected by two unfortunate external circumstances that were out of my control. First was the Covid-19 outbreak, which might have had an influence on my ability to carry out the interviews. At the time of my visit, the number of cases was low in Ethiopia. Coming from a region with a high infection rate (Europe), I was occasionally perceived as a possible virus

carrier. One time, a relevant informant refused to talk to me, as he was afraid to come near me.

Secondly, a violent crisis in Tigray region (a region in the North of Ethiopia) affected the security situation in the country. Due to new security measures, entering the field required additional administrative steps – a permit from the Water Bureau. As the conflict sparked at the very day of my arrival to Ethiopia, I couldn't obtain the additional permit from my position at the time. Generously, I was offered by PiN office in Awassa to visit the locations as a staff member of the organization. I accepted this offer, as it was the only option to continue with my research.

Based on a recommendation letter from PiN office and several meetings with officers from the Sidama Nation Regional State Water and Irrigation Development Bureau, I was granted a *support letter*, allowing me to enter the desired locations.

Being in close contact with the PiN office in Awassa had a significant and positive impact on my research. I was able to consult all research-related issues with experts right away and get accurate and useful information. Also, I received great support in logistic issues - renting a car, finding an interpreter and other similar tasks.

After overcoming all the practical obstacles, I was able to reach the field and start with interviews in the Sidama region. I spent one day at each location (Teso, Bargo, Huluka, Daye, Agre Salam, Bona), accompanied by an interpreter. Every question was asked in English, then translated to Sidama language (Sidaamu) and the answer then translated back to English. My colleague grew up in the area and Sidaamu was his mother language, which made the communication much easier. It is important to mention that despite our effort to make the translation as exact as possible, some shortcomings might have occurred, especially during the first few interviews. As we proceeded, our cooperation became easier. My colleague had a chance to learn the point of my questions, and it was easier for him to explain them to the informant. An important part of our cooperation was the relationship we developed - overcoming social and communication barriers, our field work was getting better every day.

Interviews held in Alaba (Gurura Buchu, Yeye, Guba Shiraro, Lowerlenda) followed the same structure. My new interpreter, a local PiN employee and expert on agriculture, spoke the local language and knew the area, which made our visits much easier. However, there was limited space for developing any personal relationship.

Conducting interviews in different cultural contexts requires special attention and approach. The identity of the researcher affects the interview and shapes the interaction with the informant even more than usual. The less common ground between the two, the more social and research skills are required to carry on the interview (Valentine 2005).

As a young white woman from a wealthy country, interviewing communities lacking basic resources was challenging. Out of respect and out of desire not to increase the gap between me and informants, I decided not to follow the common practice of audiotaping the interviews. The risks of audiotaping are articulated by social researchers (Douglas 1985; Dunn 2010), e.g. avoiding controversial topics by informants. A technique of note-taking was used instead.

With every informant, a sheet of prepared topics and open questions was used to ease the note taking process. It helped me to follow the structure and keep up with the respondent. After every interview, I went through my notes with my colleague (interpreter) and together we checked the data and added if something was missing. Every day, I transcribed the data and added more details and nuances I could recall. Additionally, I kept a research log, where I recorded my personal experience, impressions and feelings. That helped me to keep track of the atmosphere and broader context of the interviews.

I believe that use of an audio recorder would have a strong impact on the quality of my data, and I wouldn't be able to reach deeper conversations and findings. With respondents not accustomed to technology, possible sensitivity of data and impossibility to set up a nice and quiet environment for interviews, taping the conversation would prevent me from obtaining satisfactory data.

All mentioned factors are discussed for example by Mattimoe and Hayes (2004, p. 12).

In the chapter presenting findings of the research, the reader will find transcriptions of the interviews to illustrate and complement my statements. These transcriptions are based on detailed notes I was taking during the interviews. It is indeed impossible to match the original words of the informants, the meanings and tone however remained.

Data analysis of the interviews was based on methods described in Dunn (2010) and Crang (2005). On the principles of open coding, data were first sorted into broader topics, and then subdivided into categories defined by literature and previous research, e.g. as in Alexander et al. (2015). Coding was done manually in text and spreadsheet editors.
Analysis of project documentation was done in a similar manner. Relevant sections were first sorted by topic and then by the affiliation to factors of sustainability.

During the interviews, I was often facing misleading or even false information provided by some of the respondents, mostly from the administration structures. I believe that motivation for providing me with deceptive information was double. First, some informants didn't want to share shortcomings or failures of their actions. Especially in terms of financial management, the rather sensitive nature of the topic imposed significant obstacles for the data gathering. Political motives could also be a factor. Being aware of such, the results were later consulted with experts and PiN representatives. Second, despite being a student, I was perceived by some of the respondents as an opportunity for securing an advantage. It was my personal feeling, later confirmed by my colleague-interpreter and PiN representatives, that some informants described the state of affairs much worse than it was in reality, hoping for a supportive action.

Additionally, data obtained in interviews face the risk of social desirability bias (Nederhof, 1985). In some cases, the obvious *right/wrong* answer may be prioritized by the informant more than the *true* one. In order

to limit the risk, I was trying to ask only neutral questions and rather let the informant speak, while directing the conversation towards relevant topics. However, in some cases it was impossible to avoid direct questions. The presence of social desirability bias was apparent especially in terms of female participation, which is known by all stakeholders as a desired project outcome. Most of the relevant water bodies confirmed at least some levels of female participation, however verification of such information with users and women often showed otherwise. In order to limit the risk and learn the true nature of the local context, I was first approaching the stakeholders from the top positions, i.e. WWO, followed by WASHCO. Then, I verified the information with users.

All respondents were informed about the reason for the interviews and gave oral consent for the data use. Names of those informants who gave their permission are stated in the *List of informants* (Figure 3). Data collected from interviews in the field, i.e. with users, WASHCO and WWO representatives, are possibly sensitive and could affect the wellbeing of the informant. For that, the identity of informants is hidden and only necessary informations are shown in the research.

6. Findings

In the following chapter, findings from my own research are presented. Every region, village and location face different challenges with their water supply system. For that, successful and sustainable implementation requires individual approach from all stakeholders, which is, naturally, confronted with the need for generalization and united approach towards common strategy. Added to that, water supply interventions combine the "software" aspects, i.e. the need to reflect behavioral reality within the target group, and "hardware", referring to technology and infrastructure present and suggested by the intervention (Mosler 2012).

For better in-text orientation, this chapter follows the conception of conceptual chapter four, which offers conceptual framework and discusses sustainability factors suggested by existing research. Every section of this chapter is therefore dedicated to one dimension of sustainability, in light of which concrete elements and findings are presented. Due to the complexity of the problem, it is impossible to avoid thematic overlaps. In every relevant case, I try to explain the relation to other sustainability aspects and justify the classification made.

Figure 3: List of informants

Code	Gender	Age	Category	Special position
01A	M	25	Woreda water office	Head officer
02A	M	45	Woreda water office	Head officer
03A	M	50	Woreda water office	Officer
04A	M	35	Woreda water office	Head officer
05A	M	35	Woreda water office	Head officer
06A	M	40	Woreda water office	WASH dep. head officer
07B	M	45	WASHCO	Committee Chief
08B	M	70	WASHCO	Committee and village Chief
09B	Focus Group	4 WASHCO members	WASHCO	Committee members
10B	Focus Group	8 WASCHO members	WASHCO	Committee members
11B	Focus Group	6 WASHCO members	WASHCO	Committee members
12B	Focus Group	5 WASHCO members	WASHCO	Committee members
13B	M	65	WASHCO	Chief
14B	F	70	WASHCO	
15B	M	50	WASHCO	Committee Chief
16B	Focus Group	8 WASHCO members	WASHCO	Committee members
17C	M	40	Community	
18C	F	20	Community	
19C	F	35	Community	
20C	M	20	Community	
21C	M	45	Community	WP cashier + operator
22C	F	20	Community	her mother is cashier
23C	F	40	Community	WP cashier + operator
24C	M	55	Community	
25C	F	50	Community	
26C	M	35	Community	
27C	F	40	Community	
28C	M	60	Community	WP cashier
29C	F	25	Community	
30C	F	70	Community	WASHCO cashier
31C	F	15	Community	
32C	F	35	Community	
33C	F	15	Community	
34C	F	15	Community	
35D	F		PiN staff	
36D	M		Expert Jiří Šíma	
37D	M		PiN staff Jan Faltus	

Source: Own research

Through analysis of policy papers, project documentation and interviews with experts and relevant water institutions, the research assesses the structure of water supply. In rural and small communities in Ethiopia, water from improved systems is available mostly from water points (WP). Users pay a given amount per *jerrycan* (20 l). At urban and some rural project locations, waterpoints have a fee collector employed by the committee. In some cases, there are "special" WPs connected to a facility (typically health center, school or church), which are not meant for public use and the facility pays monthly according to the connected water meter. In semi-urbanized areas, a household pipeline network sometimes complements existing WPs. Such a service is usually available only to a limited number of households, with monthly payments according to an agreed tariff.

The administration structure differs according to the location type. Urban systems are managed by *water management offices*, which are the lowest administrative units of the water bureau. They are connected to the central water structure, they are acknowledged by regulations as a legal body. The following text uses a label *Enterprise,* as such is used in Ethiopia. In rural locations, the water supply systems are managed by water committees. In the past, they were known as a WASH Committee (WASHCO), and this label is widely used by practitioners and researchers. Due to an administrative change made by SNNPR regulation (SNNPR 2012), the body has been transformed into the *Water Users Association*. Except for a different name, its legal status has been modified. Its establishment requires a registration, accountability and responsibilities are acknowledged by the document, along with detailed description of its duties and rights. However, in this thesis, the old label WASHCO is used for two reasons. First, the change is, in practice, administrative and no important difference has happened on the ground. Many WASHCOs are still existing under the same status, as they never registered and followed the new regulation. Second, the label WASHCO is widely acknowledged in Ethiopia and by the international water community. For better orientation and understanding, I decided not to fracture the already complicated matrix outlined on the following pages.

6.1. Contextual environment

NATURAL ENVIRONMENT

Interviews with users and WASHCO representatives indicated that presence of alternative water sources (streams, ponds) determines the user's demand for an improved water source, and subsequently the amount of fees collected by the WASHCO. As fees are usually the only income, it determines their ability to maintain the system and secure its functionality. If an additional water source is present, it is often used for secondary purposes, as laundry, bathing or cleaning. Improved water source is then used primarily for drinking. In arid areas, an improved water source is used for all purposes, as it is often the only water present.

As emphasized by users, if no other water source is present, the financial and practical burden of water collection increases, as all water has to be bought and brought to the household. In areas with insufficient coverage, walking distances reported by informants went up to 10 km for a round trip (Informant 33C). Additionally, if the system supports a high number of users, time needed for water collection increases by waiting and queuing.

> *"I go for water every 2 - 3 days, I change with my mother and sister. Our household is 5 km from the waterpoint, but it is the closest, because we live on the border with Oromia. One trip usually takes me about 5 hours, but if there are a lot of people, I wait, maybe about 2 hours."* (Informant 34C)

Existence of naturally occurring water sources can have a negative impact in terms of institutional interest and support towards the community. As many villages lack access to water, those with unimproved, but all year present sources can be "forgotten" by the administration, as they have *at least some* water.

"Nobody cares about us. We asked the woreda many times, but nobody cares, because we have the river. But it is not clean, we are getting sick from the water. My household is 2 km away, but many people have to walk much more." (Informant 25C)

The water use is further determined by seasonality, as even in arid areas, rainfall increases in winter, creating additional water sources, such as springs and "ponds". Seasonality has a direct impact on the WASHCO budget and its ability of system maintenance, as smaller demand for improved water means their income decreases. For example, all seven informants interviewed in Alaba (where no surface water is present in the Summer) reported similar strategies in water use, as demonstrated by following informant:

"There is no other water now, so I use it for all purposes. But in winter, I buy it only for drinking, because I can use ponds created by rain." (Informant 32C)

Important natural factor is the water quality, as in some cases high occurrence of minerals can be a serious health risk. Namely in Alaba Special Woreda, its geology imposes a serious problem, as high levels of fluoride require additional treatment of underground water. The issue is further discussed in section 6.4.

Picture 1: Source of drinking water in Teso

Source: Author

PHYSICAL INFRASTRUCTURE

Through interviews and observations, the research showed that available physical infrastructure and its level is an important factor of the water supply system sustainability, as it directly affects its functionality and options for support. First, bad roads complicate the access to local markets in order to get needed spare parts for the system maintenance. More specific parts might not be even available at the local market, and obtaining them requires a several-hour trip (if even possible).

> *"We can get simple spare parts in Alaba, but if we need something specific, we have to go to Sodo[1]."* (Informant 14B)

Even a simple error, such as a broken faucet, can put the system out of service for days or weeks, before the spare part is acquired. Some locations are accessible only by a "summer road", however even in the Summer some of these roads are accessible only by a motorbike due to broken and muddy

[1] About three hours drive one-way.

ground. In case of a major problem, the presence of a technician is needed to identificate the problem and offer a solution, however such physical obstacles can be a serious complication in order to have him.

Second, the poor level of electricity coverage and service increases financial costs for operation and maintenance of the water systems and threatens its functionality. All stakeholders included in the management structure[2] reported that the responsible body, the Ethiopian Electric Power Corporation, faces lack of financial and human capacity and therefore the progress towards coverage expansion is very slow, as it often takes years to get access to the network. This problem was demonstrated in one of the interviews:

> *"If you need electricity somewhere, it takes years. You apply and pay, and then it takes like four years for them to build the pillars. After two more years, they put up the wires. And then another two before they actually connect you to the network."* (Informant 35D)

According to the project's designs (PiN 2013; PiN 2017; ČRA 2011), every borehole should be connected to the network to power the pump, and equipped with a generator as a back-up solution in case of power cut. The absence of an electric network leaves only one option of powering the pump - a fuel consuming generator. The recurring fuel cost puts is a great challenge on the WASHCOs, as most of the budget is used to cover fuel expenses. All visited communities with a functional transformer[3] reported at least some ability to save extra money from the collected fees. On the contrary, communities dependent on generators were facing serious financial problems, not able to put any money aside. Research showed that recurring fuel expenses were the biggest financial burden in all locations dependent on

[2] Representatives of WWO, WASHCO, PiN, experts
[3] Electric Power Transformer

generators. The ability to save money is extremely important for the WASHCO's ability to maintain the system, i.e. to afford minor (and ideally also major) repairs. The committee unable to have savings is extremely vulnerable and the system can become non-functional until another solution is found (e.g. WWO or other institution offer support).

> *"We have had problems with the generator for a long time. First we lost the key and we had to buy a new one. Then there was a big problem about one year ago and we used all our money to fix it. But the problem continues, we asked woreda to help us and they sent a technician, but since then the generator consumes 25 litres / three hours. Before it was 75 litres / 15 days. We use all the money for fuel."* (Informant 15B)

If the electric network is present, another problem arises. In order to increase the water supply coverage, if a system is connected to an electric network, WWO sometimes takes the generator designated as a back-up solution and uses it at another location with a need for a power source. From ten studied locations, five were powered by electricity (Bona, Daye, Guba Shiraro, Gurura Buchu, Yeye), but only two had a backup generator (Bona, Daye). System in Agere Salam was powered by a generator due to transformer error.

It is true that the needs of other communities are hereby satisfied, but absence of a back-up energy source exposes the system to the recurring power cuts. The frequency of power cuts at some locations[4] was reaching 10 days a month, causing an interruption of the service.

When the system is not functioning, people collect water at other places. Along with increased burden on the users, it negatively affects the size of the budget. Often outages undermine the reliability of the system, as water is not present when expected. This may cause a decrease in user's interest and

[4] Mostly in Alaba Special Woreda, but in the past also in Daye..

further budget reduction. Such can lead to worsening sustainability, as WASHCO lacks the finances needed for operation and maintenance. This reasoning was indicated in one of the interviews:

> *"If the system is unreliable, people get used to it and learn to use alternative water sources. But if the system is functional and stable, they also get used to it. Then they require it, which is a strong incentive for the management body to keep it running."* (Informant 35D)

Picture 2: Nonfunctional waterpoint in Teso

Source: Author

INSTITUTIONAL SUPPORT

The research showed that because WASHCOs often lack sufficient finances and skills to maintain the system on their own, its functionality over time is dependent on external support. According to official policy (SNNPR 2012), this support should be provided by the WWO, as it is the only institution constantly present. In some cases, this support can be provided by implementing agencies (e.g. NGO), however due to project-base setting, support, particularly after the end of project implementation, can be problematic.

The PiN organization, thanks to its long term presence in the studied regions, is occasionally able to provide such support. However, the main communication channel is kept with the overseeing WWOs, and therefore communication of a problem (and its solution) is still dependent on the WWO knowledge of administered kebeles and their supply systems.

The financial and human capacity of WWO is usually insufficient for the size of the administered area. Most often, the only income of the WWO consists of a yearly budget from the higher administration, the Regional Water Office. As reported by the WWO officials, the budget is not enough to cover even the regular expenses connected to the duties of the office, such as monitoring and technical support to the kebeles. Such problem was articulated also by WASHCO representatives, as illustrated by interview by a former WASHCO member from Teso:

> *"Many times we contacted the WWO and the Regional Water Office. They never provided anything for us, they didn't want to help. When the pump broke down, they sent a technician to remove it. That was the only support we got. (...) Yes, we had to pay the fuel and per diem for the technician."* (Informant 26C)

Small budget seems to have a serious impact on WWO's human capacity, as low wages are unfortunately compensated only by a high amount of duties. For example, the population of Bona Zuria woreda is around 180 000, living in 25 kebeles. The WWO has only 56 employees, as for low wages it is extremely complicated to employ (and keep) personnel. From 56 WWO officers, only eight have been reported to have adequate formal skills - seven engineers and one hydrogeologist (informant 03A). Additionally, due to insufficient wages officers have insufficient motivation to put bigg effort into their jobs. As such a situation has been observed in all studied cases, it can be expected as quite usual. If so, the whole system is cripled, as WWOs are the lowest administrative units with stable (state) income and therefore responsible for WASHCO support.

> *"The state and the community are the worst managers. (...) All big cities in Ethiopia are facing severe water shortages, in Addis the pipeline is 60 years old, the leakage is responsible for about 60% water loss. But the effectiveness makes no difference for the bureaus financially, so they don't care. In the villages, there is a problem with skills. You basically take a villager and you make him a water manager."* (Informant 36D)

According to the project documentation and the PiN strategy, after finalization of a project (i.e. construction of water supply scheme), the system is handed over to the WWO ownership, along with all documentation and relevant materials. This practice follows the principles defined by the *Development Cooperation Strategy of the Czech Republic* (MZV 2017), which stresses the need for intervention ownership by the recipient community. In this case, it is a question how beneficial this practice is. High staff turnover and poor office organization often leads to unavailability of these documents. In fact, the WWO often has no specific information about the water systems, because all the documents have been lost, forgotten or simply locked.

"We don't have any maps of the pipeline, so when something goes wrong, we don't know where to dig." (Informant 01A)

A clear chain reaction can be observed here. Poor setting and insufficient capacity of the WWO is projected into their work, affecting the WASHCOs and directly the sustainability potential of all water supply systems included.

"We have no regular communication with the (Woreda Water) Office. (...) If we need a technician, we call and they send him, usually it takes two or three days. But he is not good, what he fixes is broken very soon." (Informant 15B)

"If something gets broken, we call the WWO and they might send the technician. But it is expensive for us. When the technician comes, we have to pay him for the fuel and per diem." (Informant 11B)

"We have no technician here, so if there is a problem we have to call the WWO. If the problem is expensive, we ask a rich person from our community rather than wait for WWO." (Informant 16B)

One of the consequences of insufficient WWO budget is that WASHCOs are charged for the services. As reported in a majority of cases, if a technician is needed, WASHCO covers the fuel needed for the travel, per diem and sometimes even the work. Such practice is discouraging the WASHCOs to solve problems with professionals and forces them to find alternative solutions. Unprofessional "repair" can worsen the problem, and therefore compromise the system's sustainability.

In most cases, the WWO support was present only on call, solicited. Majority of WASHCO representatives stated during the interviews that unless

they ask for assistance, there is no regular oversight from the WWO. Only exceptions were kebeles which were also administrative centres of the woreda (Agere Salam, Bona, Daye), and therefore the WWO was located there. However, most of the WASHCO representatives reported that if there is a major problem with the system, WWO is able to help and provide technical and even material support.

This situation was later consulted with PiN expert on WASH and Ethiopia, Jan Faltus. As a reaction to this problem, a reporting system *WaterReport* was launched in 2014 in Alaba. WASHCO are provided with a mobile phone, in order to send a SMS message at least once a month. The system provides them with the option to contact the WWO and also send regular data on water consumption or money collection. The data are collected and displayed on an online map, so the WWO can access the problem and send a technician.
The creation of WaterReport was not included in any project funded by the Czech Development Agency, and costs for its development and existence are mostly covered by PiN organization's internal funds (Informant 37D).

6.2. Implementation

As confirmed by all local informants, the intervention was wanted by users and water institutions, and perceived as an important improvement of the living standard. All the communities showed interest in long term functionality of the system and acknowledged its benefits. Presence of community interest can be seen in user's participation during the construction present in all studied cases, most often by labor and material. Some communities also organized a money collection to cover initial expenses.

Interesting insight on project strategy was assessed by the research. Selection of target locations in Sidama has been done by the donor, the Czech Development Agency as preparation stage for long term programme. It was based on analysis of the region, interviews with the administration and local

communities, in order to identify suitable project locations. This insight was provided by one of the interviewed PiN representatives (Informant 35D), who is a former employee of the Czech Development Agency and attended the identification field visit. As suggested by the informant:

> *"We visited as many villages as possible to see the situation there. At the time, we were the only donor doing such a thing. But if you are about to initiate a programme, you have to know the location. So we went almost door by door to learn about the problems in different communities and decide where to drill."* (Informant 35D)

According to the project documentation and interviews with PiN representatives, focus groups and meetings with the community were preceding all interventions. Such connection has shown not to be only useful in terms of improving the communication among the benefiting communities and PiN, but also strengthened the trust among both.

> *"Communities at all locations cooperated and enabled the heavy equipment to enter the summer roads (especially in Guguma[5] and Bargo)."* (PiN 2015a, p. 7)

Initial demand and participation is believed to increase the sense of ownership (see section 4.2). However, the research indicated that it is problematic to build a sense of ownership solely on such, especially in urbanised areas. First, the systems often serve more users than intended. Some of them didn't have the chance to participate in any way, some don't remember the implementation, and except isolated villages, the users do not

[5] Construction of a new borehole was planned in Guguma under the same project as Teso, Bargo and Huluka. The borehole was abandoned and the location excluded from the project in 2015, as despite continual drilling the the aquifer wasn't captured (PiN 2015a)

constitute a community. For that, it seems rather optimistic to expect any common sense of ownership among a mostly random group of water users. Only in remote places (e.g. Bargo, Huluka), the users are in daily contact and can be considered as a community.

As system maintenance requires different skills, training is an absolutely essential component of sustainability. Indicated by the project documentation (PiN 2015a; PiN 2016; PiN 2017) and confirmed by PiN representatives (Informant 35D; Informant 37D), training by PiN has been provided before the system was launched, typically on financial and technical topics. In rural locations, the importance of clean water and hygiene habits has been assessed in focus groups with users. Establishment of WASH committees and Water User Associations was supported by PiN, along with all necessary legal steps such as registration or selection of its members. The tariff setting was also supervised by PiN and based on the analysis of "testing phase", in order to assess the real number of users, average budget income etc.

> *"It is absolutely essential to calculate the expected flow and water consumption. Only then you can design the tariff and carry on with the project. But for that you need to know how many people will fetch water. If the tariff is too small, they are not able to collect enough and the system becomes unsustainable right away."* (Informant 37D)

> *"On the basis of the conducted monitoring it was decided to conduct two days training on cost recovery analysis (...). The training was mainly focusing on self-financing and sustainability of water schemes and water sources, service charges and membership contributions."* (PiN 2017, p. 7)

However, lack of skills and poor professionality was observed at all locations, and viewed as one of the biggest bottlenecks of sustainability. Interviews with the WASHCO representatives showed that only a very limited level of skills is often present within the group. Similar problem was revealed with WWO members, as presented in the subsection on institutional support.

Importance of skills was illustrated by WASHCO member from Huluka, a remote village with bad road access:

> *"Thanks to the training provided by PiN, we are able to do minor repairs without a technician. (...) We don't have any technicians here in the village, but one member of the committee has the PiN technical training. It saved us a lot of money."* (Informant 11B)

Many WASHCOs reported that most of the knowledge was forgotten or lost due to high turnover, and they would need more training. However, mostly because of the project-based structure of the development cooperation, such ongoing activity is problematic.

> *"The work with the community is crucial and it should be expanded, in many cases the community is what makes the difference. But to be able to support them along the way, help to build the organizational structure and build the skills and capacities needed on a good level… The project would have to last ten years. First to build the system and then work with the community."* (Informant 35D)

The need for such a change has been articulated by the *Report from the complex evaluation of the development cooperation of the Czech Republic in the sector water supply and sanitation in Ethiopia* (MZV 2014, p. 18). Among other things, the document recommends restructuralization of the system, so continual capacity building is possible.

It is important to mention that the need for the water management bodies professionalization is not neglected by the implementing agency. As suggested by PiN representatives, through workshops, cooperation with WWOs, the higher administration and other donors in the area, PiN is consistently trying to invent opportunities for the water responsibles to improve their skills, despite the structural obstacles. One of such events is for example described in the Annual Report from Sidama as follows.

> *"Due to the high turnover of staff, it was decided to conduct two days Refresher training. (...) The training was mainly focused on existing gaps and next actions in order to achieve an organized and updated database system in the woreda. (...) As part of capacity building intervention, PIN organized and conducted training for caretakers (local technicians) and operators."* (PiN 2017, p. 8-9)

Part of implementation is the technology selection. The water system type is always given by the hydrogeological and topographic circumstances, and therefore decided by relevant experts. It is however affected by the supply chain and local market, as the desired device might not be available. In general, the supply of water related technology in Ethiopia is very diverse, as the available technology has origins around the globe. As a result, there is huge variability of the systems and connected infrastructure.

> *"The pumps and other infrastructure and its parts can be from China, Italy, Germany, Japan. For every dog a different master. And none of the systems are designed to last forever, they need maintenance, service… Half of those systems stop working after a while, but no one can repair it. Imagine what happens if you need to replace just a small part of a generator made in China. They can't just buy it, they don't know what to look for or where, how to order it. They have some*

training, yes, but they know how to run the system, how to turn on the electricity, not how to repair a generator. It's a deadly thing for long term functionality." (Informant 36D)

6.3. System Governance

The character of the location (rural/urban) and its overseeing body determines problems connected to the system governance and its sustainability is challenged differently. Detailed description on the structure and institutional organization of the water sector in Ethiopia is offered in section 2.3. The following chapter is divided according to the rural/urban nature of the studied locations.

6.3.1. Rural areas

The research showed that rural WASHCOs often lack skills needed for securing the system functionality. For that, they are heavily dependent on external support, which is not always present. If a problem occurs, its solution can take days or weeks, depending on its severity. It is one of the major bottlenecks of sustainability, as in the meantime the system's functionality is limited, or even terminated.

Technical skills are the most common problem. However, all WASHCOs interviewed received some kind of training in the past, the benefit from it decreases over time. Among reported problems, forgetting skills was the most common, as illustrated by following interviews.

"When they built the system, they told us how to take care of it. But it was five years ago. We are able to do some small repairs, like faucets, but for anything else we need a technician. But we have been lucky, there are no big problems with our system." (Informant 11B)

"We had training for the operator three years ago. But we would be happy to have some more, because it is easy to forget. (Informant 15B)

Most of the interviewed WASHCOs were able to collect the fees according to agreed tariff and secure income necessary for covering operation and maintenance expenses. However, the tariffs were often very little, with the lowest price of 0,5 ETB/20 l jerrycan. As for July 2021, that is 0,0096 EUR. With such tariffs, WASHCOs often struggle to cover all the expenses (i.e. fuel, repairs, spare parts) and they are unable to save extra money. It can be assumed that if a major problem occurs, WASHCO without savings is dependent on external help. In such a case, the system will be most likely nonfunctional for weeks or even months, before the assistance is arranged and delivered. The speed of the assistance, among enthusiasm of the woreda officers, can be further influenced by political factors.

However, increasing the tariff could threaten the ability of the poorest to afford water. That wouldn't be socially acceptable, and it could also reduce the amount of users and subsequently the budget income. The need for affordable tariff is also stressed by project documentation (*PiN* 2016; *PiN* 2015a).

"The WASHCO never collects enough money. Even if the tariff is set right at the beginning, so the system is financially sustainable, there can be a politician from higher office telling them to make it cheaper. Then he gets the political credit, because he was the one who made water more affordable." (Informant 35D)

Most of the WASHCOs were able to secure maintenance at a level necessary for at least partial functionality of the system. However, activities connected to the system functionality indirectly, such as record keeping or regular community meetings, were widely neglected. It is important to say

that revealing the absence of these elements was quite problematic, as WASHCO members often tried to pretend that these activities were taking place, mostly by confirming their presence in the interviews. However, when the community was interviewed, it was reported that for example no meetings or communication is happening. Such a situation was observed in Bona, where the following interviews with WASHCO and users were carried out.

> *"We are in touch with the community daily, and quarterly there is a meeting to discuss issues about water."* (Informant 09B)

> *"There are no meetings for the community, I don't know how the Enterprise works."* (Informant 20C)

> *"I never heard of any meeting. I would go."* (Informant 19C)

Absence of monitoring and evaluation activities was also often observed. According to interviewed WASHCO representatives, only monitoring organized by PiN (discussed in section 6.8) was taking place at some locations (WaterReport). In three cases, the absence of monitoring reported by WASHCO directly contradicted the information provided by the relevant WWO, which stated that there are regular visits and data gathering.

Important factor of sustainability consists of accountability of stakeholders responsible for the system. According to interviewed WASHCO and WWO representatives both in rural and urban context, misuse of the money has been reported in the past. Unfortunately, no punishment took place. From 16 WASHCO and WWO informants, four reported misuse of the money by a former co-member[6].

[6] Misuse of the funds is sensitive information, and it is possible that there were more cases among informants than revealed.

Absence of accountability puts more suspicion on those who handle the money, disrupting the possible trust from the community. In all cases recorded in the interviews, the guilty person had to quit his position, but there was no legal consequence.

According to the SNNPR Regulation No. 102/2012 (SNNPR 2012), the committee and its members are legally accountable for their activities, i.e. the use of financial and other resources. However, enforcement of such would require a legal accusation, which is very unlikely to happen.

6.3.2. Urbanized areas

As urbanized areas usually have better connection to roads and other infrastructure, the potential to acquire skilled personnel is higher than in rural places. As the supply systems often include (along with WPs) household pipelines (e.g. Daye, Bona), a certain level of expertise is necessary. However, a threat to sustainability consists of consequences of small wages and subsequent poor motivation and turnover, which can be illustrated by following interviews with Enterprise representatives.

> *"You know, there is always a problem. The working hours are long and it is always something to do. You see now, it is five o'clock and all of us are here."* (Informant 10B)

> *"Yes, one year ago PiN gave training here. But the people who received it left and got a better job in the city. Nobody can forbid them to leave, but now we miss the skills."* (Informant 07B)

The research showed that there are no continual opportunities for the Enterprise members to acquire training and improve their skills. It can be assumed that the knowledge is therefore unstable and insufficient, as also reported by PiN representatives. Unprofessional approach to problem solution, no matter if the problem is managerial, financial or technical, results

in poor quality of the service and therefore threatens its sustainability. Staff turnover is further weakening the system, as skilled officers often leave to seek better opportunities elsewhere.

The population of studied urbanized areas was much bigger than rural locations, which means more users of the water system and rather stable budget income. Road access and presence of supporting infrastructure, such as specialized shops for spare parts, electricity or internet coverage, is assumed to improve the Enterprise ability to maintain the system's functionality over time. However, operation of the urban systems was described by Enterprise representatives as complicated and time consuming. Number of waterpoints is connected to the borehole(s), and in some cases a network of household pipelines is also supported by the system. Requirements for operation and maintenance are therefore much higher.

In urbanized areas (and some rural), water points have their own operator-cashier. As observed at the visited locations, this person usually lives next to the WP and is responsible for its functionality, fee collection and reporting to the Enterprise. The operator receives a monthly wage (200-300 ETB), only in a few cases the wage was dependent on the water outflow. If a problem occurs with the waterpoint, the operator reports it to the Enterprise, which should facilitate the repair.

Decentralisation of the responsibility is surely beneficial for better overview about the functionality of single waterpoints, as the Enterprise capacity is limited. However, it was observed that a big part of the responsibility is transferred to the operator, which possesses no power or budget. As reported by the operators (e.g. Informant 21C, Informant 28C), all connected money is handed over to the Enterprise, which can later decide about repair expenses. If a problem occurs and the Enterprise is not acting, there is almost nothing the operator can do. Poor accountability of the Enterprise and small interest in problem solving has shown to be a problem in a number of cases. As presented in section 6.1, presence of another water source can reduce the enthusiasm for repair investment of the improved system by the external body. In urbanized areas, there is always another source - mostly a more

distant waterpoint or a donkey service. Such practice puts the whole system at risk, as the same number of users is dependent on a smaller number of waterpoints. Worsening accessibility is forcing users to find alternative solutions, which further undermines their trust and willingness to participate in the system.

6.4. Functionality

Except for one location (Teso), all systems visited were functional. However, different levels of functionality were observed, as a variety of operational problems was present. In the interviews, four measures of functionality were assessed: affordability, accessibility, quality and quantity of water. Problems observed were not serious enough to prevent the system from functioning, however placed an obstacle for users to benefit from the system as intended. The ability and willingness of users to participate in the system (by water purchasing) has a direct impact on the ability of the overseeing body (WASHCO, Enterprise) to maintain it. Decreasing satisfaction with the service (i.e. long waiting time, high price, poor quality of water, walking distance) can lead to a diminished number of users, which can quickly result in a system failure.

All functional systems were perceived by the community as affordable, considering the tariff set by WASHCO or Enterprise. In two cases, users reported that the water was given for free for the poorest, who were not able to pay for water regularly (Gurura Buchu, Huluka). It was beyond scope of this research to prove actual water quality, however water quality perceived by users was good in majority of cases. However, non-functional fluoride treatment stations in Alaba suggest that perceived quality could be very different from the quality proved by a standard analysis of water samples.

In locations with high fluoride concentration, the water is designed to be purified before drinking. Such is done by *chemical water treatment stations,* which are basically additional reservoirs designated for the purification process. According to the theory and project's design (PiN 2015b), before the water is sold to the users, it is kept in the treatment station for two hours - that is the time needed for the chemical to eliminate fluoride. After that, water is safe and ready to drink. Interviews with WASHCO representatives revealed two serious constraints of this design, causing its failure – in all three cases assessed, the treatment stations were non-functional.

First, chemicals needed for water purification are not often accessible on the market. Second, waiting time needed for the process further extends the time burden connected to water collection. As many users collect water early in the morning, there is no time for water preparation. As the presence of fluoride in the water is not visible, most of the customers prioritize untreated water over a two-hour wait. This practice is supported by the fact that most of the users lack knowledge about the connection of health problems and consumption of untreated water. However, the most common consequence of long-term fluoride exposure, the skeletal fluorosis disease[7] (Mohammadi et al. 2017), was possible to observe by a naked eye on a regular basis in Alaba region, where the high fluoride level occurence is combined with no additional water source.

Water quantity on the premises was often observed to be affected by the number of functional faucets. As mentioned before, a problem unable to cause the system failure was often left unnoticed by the responsibles. However, the quantity of water available (and subsequently the quality of service) is limited, if only one faucet out of four is working, which means that only one person at a time can fetch water.

Picture 3: Queue at Guba Shiraro

Source: Author

[7] The skeletal fluorosis causes, among other symptoms, calcification of bone and joint structure. These changes can develop into serious physical disability, as the calcification results in twisted limbs and fingers.

In all supply systems assessed, up to one third of connected water points (the number of water points ranged between 2 and 17) were nonfunctional. Functioning water points were serving a much higher number of users than intended, often resulting in queuing and long waiting times. Such problems were observed especially in areas where no other water source was present.

If other water sources can be used, it is possible that users would give priority to unimproved (and potentially dangerous) water sources rather than spending a lot of time and energy to use more distant improved sources *to buy* water. Insufficient water quantity could be therefore limiting not only regarding the appropriate functionality of the system, but also its possible health outcomes.

Due to insufficient coverage, five out of 17 interviewed users reported that water from the system is inaccessible for them on a daily basis, as they live too far from the closest water point[8]. Instead, they reported the use of a "secondary water service". It is done by a "middlemen" (Banerjee and Morella 2011, p.164), offering the water delivery by a donkey. Waterpoint tariffs are usually about 0,5 - 1 birr/jerrycan, but the cost paid by households for the donkey-delivered water is several times higher, as indicated by the following interviews.

[8] One of the five cases was in Huluka, where unimproved river water was delivered by a donkey service.

"It is not functioning for two years now, because of leakage. We asked the Enterprise many times to fix it, but they are corrupted and they do not care about distant places like ours, they only benefit themselves. (...) It is very far for us to get water and we have to use the donkey service. (...) The price is 6 birr for jerrycan." (Informant 19C)

"Everyone now takes water from the river, that is the only water around. I am lucky, because I live only 2 km from the river. People who live very far have to use the donkey service. (...) One jerrycan is 10 birr." (Informant 25C)

"If there is a power cut, there is no water. People wait or go to other water points. (...) Usually that happens around 10 days per month." (Informant 12B)

Reduced functionality makes the supply system unreliable in the eyes of users. In many cases, the only motivation of users to participate on the system is that they do not have any other option. This perspective is obviously understood by the majority of the responsible bodies, resulting in very poor service balancing at the brink of failure. In some cases, the problem is as trivial as forgetting to bring fuel for the generator, as observed at the location of the following citation.

"We use this water for all purposes, because there is no other source in summer. If the system is not working, I usually go to Alaba town. But now I will wait, because he will bring the fuel and it is faster than going to Alaba. (...) I am used to waiting here. (...) It happens around three times a week." (Informant 31C)

6.5. Community characteristics

The ability to manage the water supply system independently over time and manage the water supply system independently, was observed to be strongly affected by the economic situation of the community. As the institutional support is not always available, communities often use their own resources to foster the system functionality. As already mentioned, even if the support is available, it often requires a payment (fuel, *per diem*). Especially in rural communities, the functionality of the system can be supported from additional funds, as a one-time contribution from a rich community member, or collection from users. If the community of users is poor and such an option is not available, the functionality can be disrupted, until a solution is not found. Recurring system interruption reduces its reliability, which can result in dropped interest of community members to use the service.

"If there is a big problem, we ask a rich person in the community to donate some money for the repair rather than the office. It is not possible every time, but it is faster." (Informant 16B)

In locations with high population density and insufficient water coverage, visited systems suffered from overcrowding, resulting in long waiting times. Demand higher than expected was mentioned by interviewed experts as often the cause of unsustainable usage of the systems, as the recommended daily

yield is often exceeded, resulting in decline of water levels in the underground aquifers.

As sustainability of water supply systems in Ethiopia is, in theory, based on community participation and ownership, the actual ability of communities to do so is essential. As discussed in section 6.3.1, meetings with the community were, according to users, not very usual. Articulation of community needs was, especially in urbanised locations, further complicated by the anonymity of a town and its numerous population.

Users of the water supply systems in both rural and urbanised areas consisted of various groups. In rural areas, the heterogeneity was a result of insufficient coverage, and people from distant households were fetching water from the system. In urbanised places, it seemed that most of the waterpoints visited had a relatively stable group of users, consisting of people from nearby neighborhoods. However, people of different ethnic and religious backgrounds were among the groups.

As management of the water supply system is done exclusively by a small group of WASHCO or Enterprise members, the participation of the wider community is possible only upon their approval and will. Especially in urbanised areas, participation was nearly nonexistent, as for example reported by the following interview.

> *"I don't know how the Enterprise works, I can't say. But I noticed that they are wearing very nice clothes all the time. Everyone thinks that they are rich from the water money." (Informant 20C)*

Unequal distribution of the benefits and inability to participate in decision making undermines community's trust in the system and results in weakened sense of ownership and therefore worsens its sustainability prospects. However, it can be hypothesized that interest of the benefiting group in

continual income from the system can improve its sustainability, as it imposes strong incentive for its ongoing functionality.

> *"Do you see that waterpoint? It is not been functioning for two years now, there was a problem with leakage I think. But the Enterprise does not care about it, about us. They use the money only to benefit themselves." (Informant 19C)*

6.6. Gender relations

Household water supply in studied locations was mostly done by women and girls. However, their participation in decision making and management of the systems was generally poor. From all members of the water body (WASHCO, Enterprise) interviewed, only one was female. From 17 community members, only 6 were male, as the interviews were done close to the water points while collecting water. None of the male informants was, however, collecting water.

Resulting from female dominance in water collection, their knowledge would be a valuable asset in the system management. By excluding them from the decision-making process, this knowledge is unheard.
The female participation is included both in the project assessments and local policies, its delivery in practice is however poor. While all WASHCO and Enterprises reported that they have female members, most often women were given only unimportant roles and positions, most offen of administrative nature (e.g. cashier, accountant). In most cases, female members were unskilled and most often without wage, receiving only *per diem* in case of a meeting.

> *"Yes, we have one woman. (...) She is the controller of women participation."* (Informant 11B)

Importance of female participation has been emphasized by the experts as well, on an example of an unspecified project in Ethiopia.

> *"This system was non-functional for a very long time, the conditions at the location were really hard. And at some point, women got really angry about it, because they were walking 24 km round trip every day to get water. So they started an initiative, their own water committee. Their husbands were laughing at them that they couldn't even read or write. And you know what? They learned how to read and write and now they have a well functioning system and good organizational structure. And it moved these women miles forward."* (Informant 35D)

However, different perspectives were mentioned.

> *"All the NGOs insist on including female participation in their projects. But especially in the rural areas, the women have absolutely no skills. They can collect money, at the top."* (Informant 36D)

6.7. Implementing organization

As Ethiopia has been a *priority country* of the Czech development strategy for more than 10 years, focus on improving water supply is continual and stable. The project selection and support done by the Czech Development Agency has inner logic and consistency. It allows implementing organizations to pursue long term partnerships and build trust and cooperation among all levels of stakeholders, as it was the reality of PiN presence and performance in visited locations.

PiN has a long tradition in development assistance, resulting in good knowledge of theoretical, practical frameworks and trends in aid delivery, as such is obvious from its strategies, policies and project designs. WASH

represents one of the traditional areas of the organization's focus; PIN implements projects on water supply in many countries around the globe. For that, the organizational know-how on WASH related topics can be considered very good. PiN representatives responsible for project planning and delivery showed, in all cases, extraordinary knowledge of all factors assessed by this research, and much more. Knowledge of local context allows them to communicate with local authorities, and their often presence in the project locations also strengthens the trust and cooperation in the famous donor-recipient relationship, which is argued to be so important for the intervention's sustainability and effectiveness.

Additionally, local PIN offices and employees provide a very much needed base for all projects-related activities. Every project has a local coordinator, which allows better access to local structures and improves communication and cooperation, as the coordinators speak Amharic and other local languages. Local offices additionally provide a logistic and security center for all stable and visiting PiN employees.

The ongoing presence of experts and representatives also ensure ongoing communication and overview on all projects, past and present. PiN staff usually have a good knowledge about problems and challenges of concrete projects. Its solution might sometimes be out of their hands, as it requires budget or power they don’t possess.

According to interviews with Jan Faltus, a WASH expert (Informant 37D), PiN has a number of internal policies on sustainability of its projects. These directives are based on principles of Czech Development Agency, but also on internationally acknowledged standards. For WASH, PiN has a number of specific indicators of sustainability, defined for example by the document *Basic Principles of SWAP (Standards in WASH Programming)* (Faltus, 2019).

Ex-post sustainability of studied projects is assessed by PiN through two important activities (Informant 37D). First is the WaterReport database,

already mentioned in section 6.1. It provides the cooperation tool between kebele and woreda level, as WASHCOs can report a problem by sending a simple SMS. The database collects data on how quickly the problem was solved, providing information about the responsiveness of the WWO office. As WASHCOs are also supposed to send monthly recapitulation of its financial performance (fees collected, money spent, money saved to a bank account), the database offers an overview of the system's financial vitality and cost recovery.
In two cases, the research revealed obstacles of WaterReports functionality. In Bargo, there was no mobile service, and additionally the device was broken (Informant 08B). In Lowerlenda, the responsible person simply decided not to send the regular messages, as it was perceived as unimportant activity (Informant 15B).

Every borehole has an automatic meter, which gathers information about the system. Additionally, PiN employees gather data on management through ArcGIS Collector application. All data are later inserted and analysed through ArcGIS software, enabling a good overview on long-term trends within the systems.

Regular internal evaluations based on ArcGis database are done by the WASH department, assessing long term functionality of the systems. One document was made available for this research, a *Final Evaluation Report* on achievements of indicators in Alaba (PiN 2016). The document offers extensive analysis on functionality, management, cost recovery, human and material capacity of WASHCOs and WWO and quality and quantity of water.

6.8. Brief assessment of studied projects

This section aims to assess all visited project locations and briefly outline observed challenges to the systems sustainability, but also examples of good practice. Except one, all water systems were functional several years after its finalization, however not fully. In each case, sustainability of the system was

compromised by obstacles of different nature, more or less serious. All systems were maintained and managed to ensure its functionality, but only in the short-term horizont. The ability for long-term planning was generally poor among WASHCOs, Enterprises and WWOs.

First, rural locations are outlined (Bargo, Huluka, Teso, Gurura Buchu, Lowerlenda, Yeye, Guba Shiraro), followed by the description of water systems in urbanised areas (Agere Salam, Bona, Daye).

6.8.1. Bargo

Bargo is located in a remote area high in the mountains. Due to the broken road, the village was not possible to be reached by a car even in the dry season. Resulting poor access to markets (i.e. spare parts) and services imposes a threat on the system functionality, as it might take days to solve even a minor issue. The system is dependent on a generator, which is reported to consume 60 l per month. As the area has surface water sources, water from the improved source is mainly used for drinking, which limits the amount of fees collected. Combined with continuing fuel (and other) expenses, the system's sustainability is challenged by the (un)ability of WASHCO to pay for repairs. It is very likely that in the case of a major problem, the community will not be able to solicit repair effectively, resulting in temporary termination of the system services.

> *"We paid for the Bargo electric connection in 2014. Until today (september 2020), they still did not connect it. The transformer is there, but without power."* (Informant 37D)

Regular visits from the WWO were reported at the location. Bargo is also part of the WaterReport, unfortunately due to absent mobile service the reporting device was nonfunctional at the time of visit. Bargo receives some external support, which improves the otherwise quite significant vulnerability of the system.

Another improving factor is the local community, which has quite strong determination to keep the system running. As the water travels were long and exhausting before the system was built, the appreciation of the improvement is obvious in the community. Another, likely contributing factor, is the common understanding of health effects of contaminated water.

> *"I was working for the Czech Development Agency at the time. We were choosing the localities in Sidama, so we visited as many villages as possible to see the situation there. (...) I liked Bargo right away for the community. It looked like every person was carrying a soap in his pocket."* (Informant 35D)

6.8.2. Huluka

Remoteness of Huluka village is further complicated by a very bad road, resulting in a similar problem observed in Bargo. Access to markets and services is complicated and often unaffordable, concerning fuel and time cost. As the wider area is quite arid, it leaves the population dependent on few water sources available. As reported by WWO, the system benefits five surrounding villages of approximately 2000 inhabitants (Informant 11B). As there is no other source and the group of users is relatively stable, the importance of the system is widely acknowledged and cherished. Relatively strong sense of ownership and willingness of users to participate was observed.

Biggest threat to sustainability in Huluka consists of lack of technical skills and inability to collect enough fees to make savings, partially due to fuel expenses on generator power. In case of a defect, the system's functionality is dependent on external support. It is however partially balanced by the fact that the location has relatively successful agriculture (crop) and gold potential, and therefore rich community members. In case of need, these members can provide a "safety net" to fund necessary repairs.
Interestingly, the functionality and performance of Huluka system was among the best, but female participation was lowest of all visited projects. Only one woman was reported to be included in WASHCO, which consisted of nine members total. Her role was "*controller of women participation."* (Informant 11B)

6.8.3. Teso

As reported by WASHCO, the system was functional for about one year after its finalization in 2016. Since its beginning, its functionality has been compromised by leaking pipes, nonfunctional waterpoints and problems with generator, which resulted in the system failure approximately one year ago (2019) due to a pump defect. Teso was the only nonfunctional system of this research.

The reality of Teso is not very different from other locations visited. Road access is relatively good, however no technical skills or external support is present. The community is poor and vulnerable, with no political importance or ties to the WWO.

Significant factor is that a permanent surface water source is present nearby, a river. It is used by all surrounding villages, more distant use a donkey service for water delivery. It is possible that the willingness of WWO to help with the system restoration is undermined by the existence of *at least some* water, and result in prioritizing other locations with no water *at all*. The same logic could be applied on the willingness of locals to take action, as they are not dependent on the implemented system.

Woreda office has denounced the responsibility for Teso non functionality, claiming that PiN never handed the system and therefore it is still owned by PiN. This was later confirmed by PiN representatives. Due to problems with pipeline and water points, the system never left the "testing phase", which precedes handover of the project.

> *"I do not know much about the Teso case. I know it is not working. But you know, I am only one year in the office, I do not know what happened there."*
>
> *(...)*
>
> *"Few months ago there was a meeting with PiN people. I told them about the problems in Teso and they promised to help with the spare parts. (...) The parts should be in Awassa by now, but nobody was able to get them yet. The office does not have the capacity to bring them here."* (Informant 05A)

During the last interview with PiN representative in July 2021, it was stated that Teso is now functional, as the new pump was installed.

Picture 4: Bargo

Source: Author

6.8.4. Gurura Buchu

Contextual environment of the Gurura Buchu system is very good. The village has good road access and good proximity to the bigger town, Alaba. The system is powered by electricity. The WASHCO is stable, with strong leadership and good connections to the WWO. There is a technically skilled person, able to handle small repairs. Chief of the committee has knowledge about responsible water pumping, as the daily yield is restricted to two 10 000l reservoirs per day, even if the demand is higher.

It can be assumed that these facts are the reason for the very good performance of the Gurura Buchu system. WASHCO is able to save extra money and place them in the bank in case of need. As the system is threatened by recurring power cuts, WASHCO is now planning (and saving) on solar panel purchase. Solar system would provide independence on the unreliable electric network and also decrease the operation costs. Relatively comfortable financial situation allows the WASHCO not only to overcome winter, when alternative water sources are used, but also offer lower tariffs in summer, when the system is needed more.

"Now we collect 1 birr for jerrycan. But only in the Winter, when people have money from the crops. In the summer we collect 0,5 birr, because people do not have money from the fields and also they need more water." (Informant 13B)

Biggest challenge to sustainability now consists of power cuts happening about 10 days in a month, causing unreliability of the system. Additionally, water quality is compromised by nonfunctional fluoride treatment, which is caused by unstable supply of the water purifying chemicals. Except that, the system is performing very well.

6.8.5. Lowerlenda

As reported by *Informant 15B*, the supply system in Lowerlenda is benefiting six kebeles. It has decent road access, however no electricity. Constant fuel costs are complemented by recurring problems with the generator, requiring additional expenses. The WASHCO has only five members, none of which is technically skilled. All repairs have to be done by a technician sent by WWO, which makes the system dependent on external support availability. Visiting technician is charging for fuel and *per diem*, increasing the pressure on WASHCO budget.
During the visit, the system was nonfunctional due to absence of fuel. When users started to gather around, the operator collected money and drove away to get fuel from Alaba town. It took more than one hour before he came back and turned on the generator. As reported by one of the users (Informant 31C), such a situation happens often, several times a week.

At the site, only one of three waterpoints was functional, due to 1) broken faucet and 2) leaking pipe, both problems occuring six months ago. The system is included in the WaterReport database, but no data is collected.

"Yes, I have the phone. But I stopped sending the messages and nobody said anything, so I am not sending it. It is not important." (Informant 15B)

It can be assumed that two major obstacles of sustainable operation are present. First, long lasting problems with generator are a big burden to the budget. WASHCO is not able to cover necessary expenses and struggles to keep the system functional at least partially. It is possible that such is a cause for poor motivation and effort of its members, which is the second obstacle observed. However, poor performance and maintenance makes the system unreliable and of very poor service.

6.8.6. Yeye

With nine kebeles benefiting from it, the Yeye system is a busy place. It is close to the main road, which makes it convenient for many users. System is powered by electricity without generator backup.

As reported by WASHCO members, there was never a major problem with the system. Added to that, the pump was powered by electricity from the very beginning. These factors most likely provided the WASHCO with a good starting point, which resulted in good functionality over time. As the system has a number of users, WASHCO receives stable income, which allows it to cover all necessary expenses.

As reported by its members, it is enough to save some extra money to the bank, but not a big amount. For a serious repair, the WASHCO would be still dependent on external support. Another threat to sustainability is caused by absence of sufficient water storage infrastructure, as only one small reservoir is at the place. For that, the pump is working all day long, resulting in huge electricity consumption and bills.

6.8.7. Guba Shiraro

Proximity to the main road and poor water coverage of the wider area makes Guba Shiraro a system of great importance. As reported by the WASHCO, 13 kebele of about 26 000 inhabitants are using the system. Such a fact results in high demand and long waiting times. The system is powered by electricity, facing the same problems with power cuts as all visited locations in Alaba Special Woreda.

"I live only 30 minutes from here. But I spend a lot of time waiting. I usually come in the morning and sometimes I wait until 2pm before it is my turn.

(...)

I am not skipping classes. School is now closed because of Covid. However, I adjust my schedule, if there is a class in the morning I go for water in the afternoon." (Informant 33C)

Stable budgetary income is provided due to a high number of users. The WASHCO is able to cover all expenses and also make savings, so in need of repair, they are financially independent. However, a problematic supply chain of needed spare parts appeared as a problem. WASHCO reported that it asked WWO for help with allocation of additional reservoirs, in order to store the water and not to run the pump all day. Even when WASHCO has financial resources to pay for the reservoir, it has been two years since they asked WWO for assistance.

"We need the reservoir, but it is hard to locate it on the market – usually they have just those small ones, for personal uses, you know, those for the roof." (Informant 12B)

Guba Shiraro is relatively stable and of decent sustainability. Power cuts could be solved in a short time by a solar system, which has been donated by

the federal government (Informant 12B) and is already present at the location. It is “only” waiting for some parts necessary for connecting it to the system. That would also improve the financial situation, due to reduction of electricity bills. Potential threat is overpumping, as the system faces high demand, which is likely to increase with population rise.

Picture 5: Lowerlenda

Source: Author

6.8.8. Agere Salam

As usual in urban schemes, the supply system in Agere Salam is managed by Enterprise. Basic infrastructure, such as roads, electricity or access to markets, is present at the location. Enterprise members have a monthly wage, equipped office and relatively stable budget income. Number of waterpoints is complemented by a system of household pipes.

In the past, the system was powered by electricity. Due to a transformer error, it was no longer able to run the pump. It was disconnected and replaced by a generator that according to the Enterprise, consumes 60 l of fuel per day.

First serious problem is fuel consumption. Amount of fuel needed for the system operation is so big that it could never be covered from the money collected from users. Simply said, the system operation costs more than it can make on payments. However, Agere Salam is the capital town of Hula woreda. It has political and cultural importance, and the matter of water availability is a political topic. For that, the WWO is supplementing the profit failure by covering the fuel expenses from its yearly budget. By doing such, it not only supports a service which is financially unsustainable and self-insufficient, but also invests valuable and scarce resources into one system, while there are many in the woreda in need of financial support.

> *"Water is a hot topic here. People are angry and they complain if the system is not working. Few times people brought jerry cans to the administration office demanding to fill them up there."* (Informant 18C)

Second problem is the Enterprise capacity and skills. Facing the problem of turnover, most of the personnel trained by either PiN or WWO left shortly after to seek better opportunities and wage. That leaves the Enterprise without skilled staff and no prospects of training, as the opportunity was already "used". Small wage further undermines the motivation of the Enterprise staff to perform better.

> *"They do not have enough people to take care of all the water points. This one is not functioning for one month now, but they did not manage to identify the problem."* (Informant 17C)

Third, no chain of responsibility, zero accountability and poor continuity in WWO are the cause why water supply problems became a hot potato. Anonymity and fragmentation of urbanized area population is further

allowing continuity of the practice. Additionally, as surface water sources are present nearby, users are not dependent on the improved water supply. Instead of counting on unreliable (and paid) service, they often choose the unimproved and potentially dangerous source.

Picture 6: Transformer house in Agere Salam

Source: Author

6.8.9. Bona

Among other assets provided by urbanised location, the Enterprise of Bona possesses one important advantage - a water resource technician with university education. Undisputable benefits of such were obvious - the Enterprise had good records, good knowledge of daily and maximum yield over time, and a good connection to the WWO. Enterprise members reported good functionality of the majority of connected waterpoints, but also budgetary shortages and inability to cover needed expenses.
However, users interviewed reported poor performance of the Enterprise, stressing the potential corruption and absence of interest in system maintenance. (Informant 19C, Informant 20C)

It is not possible to make any valid conclusions based on such information. However, it is possible that sustainability of the system is, in this

case, challenged by the corrupted Enterprise and its members by misusing the money collected on fees. As all other factors discussed in this thesis are positively present in Bona (e.g. road, skills, stable income), it calls into question the Enterprise performance.

6.8.10. Daye

Daye is a growing town of a population of about 30 000. As for today, there are three boreholes in Daye, however only one functional. One borehole is under construction, another one ceased to work about three years ago due to a broken pump and disconnected pipeline. As reported by the Enterprise, there are 17 waterpoints in town, however only ten are functional. About 2000 households are connected to the pipeline.
Enterprise has a very good position - functional electricity without major power cuts, stable income and monopol on the water services. As Daye has political importance, they receive external support from the WWO. However, the system still faces challenges.

Users were complaining about the inability of the Enterprise to maintain the system and facilitate needed repairs. In summer, as one borehole is not able to meet the water demand, users reported that only a limited number of waterpoints can have water in one day. A system, which waterpoints are functional on which day, has been agreed on. If needed, there is an additional water source - a spring in the middle of the city. As it is surrounded by houses and animals, it can hardly be considered safe.
As a result, the water supply is unreliable and, especially in summer, often interrupted. There is no will or initiative to improve the situation from the Enterprise, as the system is somehow functional. People can get *at least some* water, no matter the service quality. Lack of motivation, caused by small wages and load of problems, is probably behind such a performance of the Enterprise.
In the case of Daye, poor motivation and willingness to improve the service is most likely the biggest threat to the system's sustainability. The Enterprise

also reported the already mentioned problem with staff turnover. Needless to say that combination of lack of skills and reward can hardly result in a good service.

> *"In Daye, the electricity power cuts used to be almost every day. One day I was just nearby, so I went to visit the hospital, which is by the way one of the worst around. And I was really surprised when they told me they have water regularly. The whole town did. It was because of the electricity. The company improved the network to Daye and the power cuts almost ceased. And because the system was suddenly stable, people got used to it, and got used to paying for it. Simple."* (Informant 35D)

Picture 7: Motorbike donated to WWO, Bona Town

Source: Author

7. Discussion

In the theoretical part of this thesis, I outline a number of factors that affect sustainability of development interventions addressing the supply of drinking water. In this chapter, I discuss how my findings presented in the previous section fit the theoretical framework and how they correspond with evidence from other literature. I will proceed from the wider (contextual) factors towards more specific ones, in order to answer the research questions outlined in the Introduction. According to my findings, contextual obstacles are the number one factor of the (un)sustainability of the studied water supply systems. The research identified a number of other problems, but these seem to be largely direct or indirect outcomes of the system in which they exist. Even if these systemic obstacles are acknowledged and reacted upon by the intervention design, facing them may sometimes be like fighting windmills.

The first research question aimed at identifying **factors affecting long-term sustainability of selected projects on water supply**. The research assessed ten water supply systems and uncovered a variety of problems and challenges. One challenge was, however, present in all examined water systems. As many other low-income countries, Ethiopia suffers from the burden of chronic shortage of resources and poor governance. Perhaps enhanced by the system of ethnic federalism and decentralization, it is a long way for the federal (or state) budget and bylaws to trickle down to the rural places and most vulnerable communities of the country. Bad roads and very problematic electrical network impose a truly compelling obstacle for sustainability of any technical infrastructure dependent on transport and energy sources. Improvement of such **contextual elements** of infrastructure would, most likely, increase the overall sustainability of the water supply systems studied. Such an assumption is supported by Taylor (2014) and his emphasis on *systemic changes,* which would allow the benefits of intervention to persist *"beyond the period of donor intervention"* (Taylor 2014, p. 1193).

Majority of water supply systems in the country are designed to be managed by the benefiting community of users. The preference for the management of these systems by local communities is extensively recommended by many strategic documents of the federal and regional governments. Unfortunately, the reality is quite different, as there is simply no **budget and lack of human capacities with adequate skills at community level**. In rural areas, Woreda Water Office (WWO) is the lowest unit of state water governance, entitled to assist communities in management of their supply systems. The WWOs face chronical budget and human capacities shortages, which makes them, in reality, unable to fulfill their purpose as a supporting organ for the community-level WASHCOs. As one of the PiN representatives (Informant 35D) suggested;

> *"The governmental strategies are quite sophisticated, there are policies and modules on a number of issues connected to water supply. They have reasonable structure, systems for training, refreshment training… But the problem is that it doesn't work in practice, as there's no money for it, poor implementation, and it doesn't see the end of the chain."*

For that, the level of external (i.e. institutional) support towards WASHCOs is very limited. Current development of Ethiopia signified by escalated ethnic tensions and civil war in the North of the country is bound to further weaken governance structures, including water-related ones. Similarly, secession of the Sidama region from SNNPR imposed yet another challenge on its water sector, as the structure is short of finances and updated policies. **External support** from outside of communities is argued to be essential for water supply sustainability, as communities and their water representatives usually don't have adequate skills or knowledge (Barnes et. al 2011, Schouten and Moriarty 2003). The system imposes great responsibility on the WWOs and WASHCOs, without providing them with means to carry out such a task. Its absence in Ethiopia is for sure a major problem of sustainable operation of all studied projects.

As described in the preceding chapter, **technical, financial and managerial skills** within the responsible water bodies are needed for planning and operation of the systems. Capacity building (i.e. training) is in most cases provided by implementing organization during the final stage of intervention implementation, as government institutions lack resources to do so. However, the implementing organization is limited by project duration, financial resources and donor's policies. As such is a common fact in development intervention, the share of investment into "soft" components (training, empowerment, community activation) was relatively small to the amount of resources invested into technology. Despite efforts to overcome these obstacles, continual capacity building activities were very limited within the studied projects. As a result, insufficient skills of the responsibles directly compromise the sustainability of the systems.

WASHCO's ability to maintain the system is dependent on its financial situation, which is derived from the **cost recovery** of the system. Ability to collect a sufficient amount of fees from users is essential for securing a) sustained functionality of the system (fuel/electricity, repair, spare parts, wages), b) saving money aside "in case", and for that makes a determining factor of the financial sustainability of the system. Right tariff setting requires the knowledge of the system's parameters, number of users, pump consumption of fuel/electricity, seasonal fluctuations and other changes in water demand. According to PiN's evaluation on Alaba projects, 126% cost recovery is needed for financial efficiency (i.e. to cover all expenditures and save money aside) of the supply systems on average (PiN 2016, p. 3). If the WASHCO is not able to recover the costs, it typically results in restricted and/or oftenly interrupted functionality of the system. In such cases, the system becomes unreliable to its users, who often have to walk a great distance to reach it. Unreliable system then loses its users (i.e. customers), and WASHCO loses income. Which results in further limited ability of the WASHCO to secure the system's functionality, closing the vicious circle.

The research showed that financial vulnerability of the WASHCO is additionally influenced by a "**starting point**". In most of the cases, WASHCO members have very limited experience with management or technology. As emphasised by one of the interviewed experts, *"they will tell you when to sow grain, but not how to fix a generator"* (Informant 36D). However, if the conditions are good at the beginning, WASHCO members may win time to learn how to operate and maintain the system. Two factors were observed in connection with the starting point. First, communities which started right away with electricity to power the pump were more likely to show good functionality over time. On the contrary, communities with generator faced high fuel costs, and possibly a technical (and costly) error with the generator. Second, communities which didn't face a major problem within the system in the first year after its finalization, were more likely to secure the functionality as well. Both aspects could possibly allow the WASHCO to find a good routine and increase the sustainability by kind of a "training" phase.

Adequate reward is yet another factor. **Motivation of the personnel** has shown to affect the sustainability of the systems very much, as a person without any motivation to perform well simply will not. Such an issue was discussed by Harvey, Reed (2007), outlining the contradicting practices of water supply in the global North and South. In their critique, authors ascribe the practice of voluntary service in the water supply sector to idealisation of rural communities, committed by international donors and implementing agencies. However, such idealisation might indeed be in place, the reason for such practices in Ethiopia is the federal water supply strategy, with international actors trying to mitigate it.

The nature of the **society and public space and culture** is an important element in the matrix of Ethiopia's water supply. Despite positive changes in many areas (as outlined by chapter 2), Ethiopia remains an authoritarian country with a strong *command and control system* and bureaucratic governance (Novotný et al. 2018). Water supply is a strategic and inherently political topic, subjected to significant incentives from central and national governments, but also local actors. Political incentives influence not only the

institutional environment and structure, but the very outcomes of the interventions, as illustrated by PiN representative (Informant 35D) as follows.

> *"If they set the price so the system is financially sustainable, it may happen that a politician comes from a higher office and says to reduce it. Then he collects political points for lowering water fees. But the system becomes unsustainable from then on."*

Problematic access and quality of **education** can be also counted for implicit factors of intervention sustainability. According to World Bank (2021c), Ethiopia had a 84.6% primary enrollment in 2015. The numbers are unfortunately compromised by a number of students dropping out before graduation, and additionally insufficient capacities of the system. The issue was mostly articulated by interviewed experts and PiN representatives, who emphasised the missing tradition of education culture and only small interest in personal growth among Ethiopians. The term *fatalism* was used several times.

Gender-related aspects are emphasised by a number of scholars (see Ray 2007) as an important social factor of water supply sustainability. As women are the most knowledgeable group in terms of water collection, their experience can have significant positive impact on the system's sustainability (UN-Water 2006). In studied projects, the female participation was rather small, as all positions relevant in the decision-making process were occupied by men. The effect of absenting female participation on sustainability of studied projects is disputable. In light of contextual bottlenecks and problems within the system's governance (and their effect on sustainability), female participation does not seem likely to have significant effects within studied projects. Perhaps the more important outcome of exclusion of women from the management of studied systems consists of restricted access to benefits, such as income or capacity building.

The second research question aims to assess **the actual sustainability of studied projects on water supply.** In the theoretical part of this thesis, I outlined several definitions of sustainability, ranging from very broad ones (Brundtland 1987) to very specific (OECD 2002; Barnes et al. 2011; Carter 1999). Although they slightly differ, all of them emphasise one general indicator of sustainability – flow of benefits that continues after the donor's withdrawal. This research showed that except one non-functional supply system in Teso village, all visited systems met this condition, i.e. delivered benefits after the withdrawal of implementing organization.

Carter (1999, p. 7) further problematise the issue, suggesting that the intervention is sustainable, if *"water continues to be abstracted at the same rate and quality as when the supply system was designed"*. If such definition would be followed, *none* of the studied projects would be considered sustainable. Even a system with overall good performance would be labeled unsustainable, as some minor problem, such as one broken faucet out of four, was always present.

The problem of narrow evaluation of sustainability is discussed by Alexander et al. (2015). Binary measures exclude other options of the system's functionality and impose "false" and inaccurate categories. Even with some shortcomings, the system can be functional and even sustainable.

As the main framework for this research was adopted from the work of Alexander et al. (2015), evaluation of findings also follows the concept. According to data presented by the preceding chapter, ongoing functionality of the system seemed to be the strongest incentive of its sustainability. Systems without serious and recurring interruptions are more likely to maintain (or even increase) the number of paying users, ensuring stable income. Effective cost recovery is an absolutely essential element of sustainability, according to scholars (e.g. Schouten and Moriarty 2003) and practitioners as well (PiN 2016). If the system is functioning regularly, it allows the users to rely on the service and include it in a daily routine and therefore spin the wheel of sustainability.

Four categories were defined in order to assess the potential for sustainable functionality of the given systems. The scheme extends the binary

measure (functional/non-functional) by two categories that assess the extent of functionality in detail. A set of four measures is suggested for each and justified as follows. First, **water availability** as an indicator of service level. Water demand that exceeds significantly the quantity of water available results in queuing and decreases the user's satisfaction with the service. Second, **cost recovery** as an indicator of financial efficiency of the system. Inability to cover expenses results in restricted functionality (and consequently, reliability) of the system. Third, **external support** as an indicator of the ability of the responsible body to ensure repairs and maintenance of the system. Four, presence of **technical skills** within the responsible body as an indicator of the vulnerability of the system towards instant failures and errors. Presence of two or more indicators within the given location is required for the categorization.

Out of ten studied systems, none was *Fully functional*. Seven systems were classified as *Functional with minor problems*, and two as *Functional with serious limitations*. One system was *Nonfunctional*. Results are presented in Figure 4.

Figure 4: Measures of functionality

		Bargo	Huluka	Bona	Guba Shiraro	Gurura Buchu	Yeye	Daye	Lowerl enda	Agere Salam	Teso
Fully functional	**Water availability -** without apparent limitations		*								
	Cost recovery - enough for maintanance and savings				*		*				
	External support - available regularly							*	*	*	
	Technical skills - sufficient										
Functional with minor problems	**Water availability -** limited, but regular and in (perceived) sufficient quantity	*			*					*	
	Cost recovery - sufficient for maintanance	*	*	*		*		*			
	External support - available on call	*	*	*		*	*				
	Technical skills - low level	*	*	*	*	*	*	*			
Functional with serious limitations	**Water availability -** recurring interruption of services			*	*	*	*	*	*		
	Cost recovery - not sufficient for maintanance or savings								*	*	
	External support - not available										
	Technical skills - absent								*	*	
Nonfunctio nal	**Water is not available**										*

8. Conclusion

Sustainability is one of the major challenges of development cooperation in general. In water supply interventions, the problem is further prompted by the complexity of its components and related interactions. In the presented thesis, I tried to assess this complexity and offer a comprehensive approach on the matter. By defining the dimension of sustainability and factors within them, the thesis offers an attempt to organize major obstacles of sustainability of studied projects in Ethiopia, which were supported by funds of the Czech development cooperation.

The empirical part offers an insight into ten project locations of rural and semi-urban nature. The fact that each system was facing a unique set of challenges within the operation and maintenance of the water supply system illustrates the complexity of the problem. The research showed that if the system is able to provide a reliable service to its users, the prospects of long-term functionality are very likely to increase. Sadly, there are still many more obstacles standing in the way. Contextual factors and challenges in the system governance consist of the major ones.

Sustainability is additionally challenged by the capacity of implementing organization and by its ability to adapt to often challenging circumstances – not only of the recipient country, but also of the institutional background of the country of origin. Political and structural obstacles, demands and expectations of governments, internal policies of the organization, all of that affects its ability to design and implement intervention with continual and sustainable outcomes.

The implicit need of water supply interventions to acknowledge specific local contexts while maintaining level of generalization and united strategy is, perhaps, without a solution. There is indeed only one way to find out – to keep trying.

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APPENDIX

Appendix 1: Table of studied projects

Appendix 2: Interview topics

Appendix 1: Table of studied projects

PROJECT	Establishment Of Sustainable Drinking Water Supply Systems In Small Towns In The District Zone Of Sidama, SNNPR, Ethiopia (ČRA 2011)			Establishment Of Sustainable Drinking Water Supply Systems In Small Towns In The District Zone Of Sidama, SNNPR, Ethiopia II (PiN 2017)			Water Resources Development and Rehabilitation in Halaba Special Woreda, SNNPR, Ethiopia			
DURATION	2011 – 2013			2014 – 2017			2011 – 2013 (PiN 2013)			2014 – 2015 (PiN 2015b)
IMPLEMENTED BY	„Sidama Water Supply" Ircon s.r.o., Aquatest a.s., GEOTest a.s			People in Need, o.p.s.			People in Need, o.p.s.			People in Need, o.p.s.
Woreda	Bona Zuria	Bensa	Hula	Aleta Chuko	Aleto Wondo	Bensa	Alaba Special Woreda	Alaba Special Woreda	Alaba Special Woreda	Alaba Special Woreda
Kebele	Bona Town	Daye	Hagara Salam	Teso	Bargo	Huluka	Yeye	Gurura Buchu	Guba Shirar	Lowerlenda
PROJECT OUTPUT - HARDWARE	Five drilled wells, a water pipe network, a reservoir network and public water points are to be built in three woredas of the Sidama Zone.			New drinking water sources are built in Guguma, Teso, Bargo and the drinking water source in Huluka is rehabilitated. The water sources are			Secured sources of safe drinking water for 2 kebele as a pilot model implemented by responsible institutions.			Imporved access to drinking water in 5 kebels (villages)
PROJECT OUTPUT - HARDWARE	New borehole, pump, generator, reservoir 100m3, pipeline, generator house, waterpoint 8x	New borehole, pump, generator, reservoir 100m3, reservoir 50m3, pipeline, generator house, waterpoint 8x	New borehole 2x, pump 2x, generator 2x, reservoir 100m3, pipeline, generator house 2x, waterpoint 8x	New borehole, pump, generator, reservoir 75m3, pipeline, generator house, waterpoint 4x, transformer	New borehole, pump, generator, reservoir 75m3, pipeline, generator house, waterpoint 5x, transformer	Rehabilitation of existing borehole, generator and pump repair, reservoir 50m3, generator house, waterpoint repair 1x, new waterpoint 4x	Rehabilitation of existing borehole, waterpoin repair 2x, new pump	Rehabilitation of existing borehole, waterpoin repair 2x, new pump	Rehabilitation of existing borehole, waterpoin repair 2x, new pump	N/A
FLUORID TREATMENT							Y	Y	Y	
PROJECT OUTPUT - SOFTWARE	• The capacities, service and maintenance of the personnel in the appropriate water bureaus in the domain of management of water sources and the water pipes network are to be enhanced. • Populations living in the targeted areas of the project are to be trained in basic principles and practices of hygiene and sanitation.			• Water associations for all water supply systems in the Guguma, Teso, Bargo and Huluka are set up and functional. • Capacity of the personnel of the WWMEO in relevant woredas and of water associations in Guguma, Teso, Bargo and Huluka in the area of management and maintenance of water sources and distribution network is improved. Local technicians are able of independent management of water supply system, operational repairs of broken water supply systems are done within 10 days of their discovery All the planned trainings and capacity building workshops were conducted to improve their capacity. • Increased public awareness of correct hygienic habits.			• Alaba special woreda Water Resource Office has the administrative and technical capacity needed to properly manage water resources. • Stakeholders at the community level (WASHCO, craftsmen and others) ensure the proper operation of water resources.			• Alaba Water Authority (WWO) has increased technical and administrative capacity and is capable adequately and quickly respond to resource failures water. • Water Commission (WASHCOs or associations) in 9 kebels have increased capacity to better and effectively manage the operation water installations.

Appendix 2: Interview topics

Woreda Water Office	1. Natural environment in the woreda 2. Training, human capacity of the office 3. Gender aspects 4. Cooperation with Regional Water Office 5. Cooperation with implementing organization 6. Cooperation with WASH Committees 7. Finances, material capacity 8. Supply chain 9. Reporting system, monitoring 10. Biggest perceived challenges
WASH Committee	1. Committee reality 2. Gender aspects 3. Information on the system 4. Initial demand 5. Participation during construction 6. Training, current human capacity 7. Collecting the fees, finances 8. Cooperation with WWO 9. Cooperation with WASH Committees 10. Cooperation with implementing organization 11. External support 12. Supply chain 13. Reporting system, monitoring 14. Cooperation with the community 15. Biggest perceived challenges
Users of water supply system	1. Basic information about informant 2. Details on water collection 3. Contextual environment of the location 4. Initial demand 5. Participation during construction 6. Satisfaction level with WASHCO 7. Satisfaction level with water supply system 8. Water quality and availability 9. Water affordability 10. Community meetings & cooperation 11. Reliability of the system 12. Biggest perceived challenges
Experts/PiN representatives	1. Basic information about informant 2. Structural and environmental specifics of project locations 3. Available infrastructure 4. Political environment 5. Phases of project implementation 6. Technology selection 7. Supply chain, local markets 8. Human resources available at the project site 9. Gender aspects 10. Training and capacity building 11. Management of the supply system 12. Finances, cost recovery 13. Accountability towards funding agency, wider frame of intervention 14. Cooperation with government and higher administration 15. Communication with other donors 16. Communication with local administration (Regional Water Office, WWO) 17. Communication with WASHCO and community